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CONTENTS

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NEW COLOUR INDEX

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THE SOCIETY OF DYERS AND COLOURISTS

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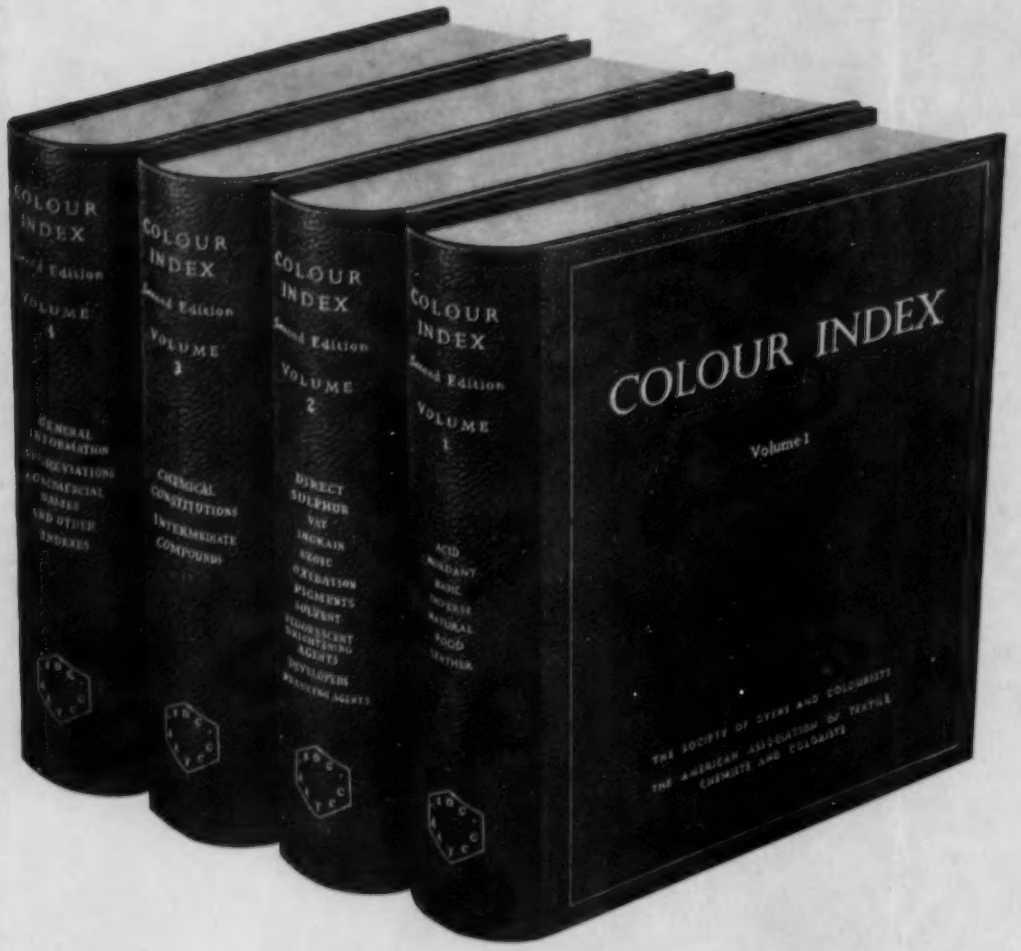

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Forthcoming Papers

The following papers have been accepted by the Publications Committee, and will appear in future issues of the *Journal* —

LECTURES

A New Approach to the Continuous Dyeing of Secondary Cellulose Acetate, Cellulose Triacetate, and Terylene Polyester Fibre — the Vapocol Process — *D. A. Garrett*

COMMUNICATIONS

Reclamation of Fibres from Rags — Parts I and II — *J. C. Atkinson and J. B. Speakman*

Relationship between Physical State and Rate of Fading of Dyes — *G. Baxter, C. H. Giles, and W. J. Lewington*

Determination of the Migratory Properties of Direct Dyes — *J. Cegarra*

The Variation of Colour Fastness on Fabrics — *S. Horrdin and Ulf Bülow*

The Use of Paper Chromatography in the Recognition of Chemical Damage to Wool — *V. Köpke and B. Nilssen*

The Measurement of Donnan Potentials with Dyed Cellulose and Aqueous Salt Solutions — *S. M. Neale and P. K. Saha*

The Effect on Wool of Boiling in Aqueous Solutions
III — Acids and Acidic Salt Solutions — *R. V. Peryman*

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President's Message

THE Report of Council gives ample evidence of the wide range of useful work which the Society has been doing during 1956. It is a record of which its members can be justly proud. To see the Society's achievements from the Presidential Chair is indeed a privilege.

During the year I have had numerous opportunities of representing the Society, both at home and overseas, including a visit to the United States for the Perkin Centennial. As a result of these experiences I have been tremendously impressed by the liveliness of the Sections at home and the manifest regard with which the Society is held abroad. It must be our continued endeavour to ensure that the vitality of our work at home is maintained and that our international reputation is still further enhanced. These are objectives which cannot be achieved by the Officers and Council alone but only by the Sections and the total Membership of the Society working in complete unity.

I should like to take this opportunity of expressing my very grateful thanks to my fellow Officers and to the Council for the splendid support they have given me during this year of my Presidential office. The tremendous amount of voluntary effort underlying this support and the freedom with which it has been given is characteristic of the best traditions of the Society and is a reason for the success of the Society in achieving its objectives. As long as this spirit prevails there is no doubt that the Society will go from success to success.

Proceedings of the Society

Annual General Meeting

The Seventy-third Annual General Meeting of the Society of Dyers and Colourists was held at Grosvenor House, London, on Friday, 29th March 1957, at 3.45 p.m., the President (Mr. CLIFFORD PAINE) being in the chair, and about fifty members of the Society being present.

The Honorary Secretary (Mr. L. M. WOOD) read the notice convening the meeting.

The minutes of the Seventy-second Annual General Meeting, held on 27th April 1956 at the Midland Hotel, Manchester, and those of an Extraordinary General Meeting held on 19th January 1957 at the Victoria Hotel, Bradford, were read by the General Secretary (Mr. J. W. NICHOLLS). They were unanimously approved on the motion of Mr. C. O. CLARK seconded by Dr. H. W. ELLIS.

Mr. H. À BRASSARD registered a protest at the footnote on the printed agenda setting out a condition of Bye-law 36 of the Society—

> The notice of the Annual General Meeting shall state the business to be transacted, and no other business shall be transacted at the meeting.

which meant that members could not raise any question under the usual final item on an agenda: *Any other business*. He was not aware of any other society which omitted this item.

The President replied that it was desirable and necessary to work within the constitution and Bye-laws of the Society, which plainly stated that business to be transacted at the Annual General Meeting was a matter of prior notice. He thought it was most undesirable that snap motions should be brought up at an Annual General Meeting, and there was ample provision within the constitution of the Society to enable any member to raise a matter through the proper channels.

REPORT OF THE COUNCIL

The Society is playing a helpful rôle in promoting British prestige throughout the world.

One of the outstanding examples of this is the Society's *Journal*, now rated as the best journal of its kind, with a circulation in forty-five countries.

Another example is the Second Edition of the *Colour Index*, the first volume of which has been published and issued to all prepayment subscribers in forty countries.

In this respect the Council of the Society welcomes the co-operation of the American Association of Textile Chemists and Colorists (AATCC) in this production, which will rank within the colour industry as a highly valued technical work of reference. The assistance of firms in Great Britain and in America, as well as in other countries, has contributed to the incorporating of five thousand dyes and pigments.

The co-operation between the American Association of Textile Chemists and Colorists, the Europäisch-Continentale Echtheits-Convention or Groupement d'Études Continental-Européen pour la Solidité des Teintures et Impressions (E.C.E.), and the Society of Dyers and Colourists has resulted in an international system of fastness tests through the International Standards Organisation (I.S.O.).

The Fourth Congress of the International Federation of Associations of Textile Chemists and Colourists was held in Florence in September 1956, when representatives of the Society attended, and the Council is pleased to announce that the Fifth Congress will be held in London on 16–18th September 1959 with the Society acting as host. On this occasion the Congress centre will be at Church House, Westminster, and the Congress Headquarters Hotel will be Grosvenor House, Park Lane, London, where the Dinner and Ball will be held on Friday, 18th September 1959.

Sir William Perkin, who was President of the Society at the time of his death, discovered Mauve in the year 1856, and in 1956, one hundred years later, the world has been given the lead by the Society in doing honour to him and his discovery, which made possible the present-day synthetic dye industry.

The December 1956 issue of the Society's *Journal* included an account of the successful centenary celebrations, and the Council takes this opportunity of thanking all the Sections of the Society for their generous support in organising most enjoyable functions in their respective areas.

Sir Robert Robinson, an Honorary Member of the Society, represented the Society in America and delivered the address on *The Life and Work of Sir William Perkin* at the International Day Luncheon held in New York as part of the American Perkin Centennial Celebrations.

On this occasion the President of the Society, Mr. Clifford Paine, presented the Society's Perkin Medal to the widow of the late Dr. W. H. Carothers, the discoverer of nylon.

Council is pleased to award Honorary Membership of the Society, the highest honour that it can bestow, to Mr. Fred Smith for long and devoted service to the Society.

Council awards the Gold Medal to Mr. Cyril Oldtree Clark for outstanding services to the Society.

The Society has now been granted the Coat of Arms and Letters Patent given under the Seals of the Kings of Arms. The Letters Patent conferring the right to use armorial bearings is a document of which the Society is justly proud*.

Council records with satisfaction that National Service Deferment has been granted by the Ministry of Labour and National Service for registered students who are taking a course of training certified by the Society.

On the occasion of the Society's Annual Dinner, held in Manchester on 27th April 1956, there was a record attendance. The principal guest was The

* See Frontispiece to this issue.

Rt. Hon. G. B. Hanna, Minister of Finance for Northern Ireland.

Cordial relations have been maintained with the Dyers and Colourists Association of South Africa and with the Society of Dyers and Colourists of Australia. The latter has submitted a scheme for closer working with this Society.

The Thirteenth John Mercer Lecture was given in Glasgow by Mr. R. K. Fourness on *The Disperse Dyes—Their Development and Application*. The Council thanks the lecturer and also the Scottish Section for the arrangements made and the accompanying display. The Council also greatly appreciates the assistance given by The Yorkshire Dyeware & Chemical Co. Ltd. in making this a very happy and successful occasion. Furthermore, the Council is grateful to the anonymous donor whose financial support of the John Mercer Lectures makes these possible.

The George Douglas Lectures are made possible by the generosity of the Bradford Dyers' Association Limited, which is very much appreciated.

Donations to the Society are gratefully acknowledged and thanks are also extended to the Dyers and Finishers' Association for the gift of a prize of ten guineas for competition between Junior Members, to be allocated to the West Riding Section of the Society.

Council thanks those bodies who contributed towards the expenses of delegates attending the International Standards Organisation Conference in America.

The Sections continue to devote valued services in the interests of the Society. The Council congratulates and expresses its thanks to all engaged in this work.

The high standard of the *Journal* is maintained and the Council thanks the Publications Committee, authors of papers and communications, abstractors, book reviewers, referees, the Indexer, the Editor of Abstracts and Patents, the Honorary Patent Agent, the Editor of the *Journal*, and all who contribute to its success.

Council is grateful to the firms, colleges, technical institutions and all others who contribute in any way whatsoever to help the Society.

The Fourth Annual Golf Competition was held on 3rd June 1956 at Leek Golf Club, Birchall, Leek, when there were thirty-four entrants.

The death at the beginning of the year of Mr. Hubert Jennison, who had given valuable service to the Society as its Honorary Treasurer, is recorded with deep regret. The new Honorary Treasurer is Mr. A. Waddington, Incorporated Accountant and Company Director.

Two further deeply regretted losses to the Council have been occasioned by the sudden deaths of Mr. A. G. Tyler and Mr. C. P. Tattersfield.

Council thanks all committees for the services they have rendered and also thanks the staff for their loyal contribution of service throughout the year.

Reports on Activities of Committees

Finance and General Purposes Committee—This Committee has been enlarged and has devoted considerable time to the administration, finances, and distribution of the *Colour Index*. In addition, the rising *Journal* costs and supporting advertisements have occupied the attention of the Committee, with a view to obtaining an increased revenue. The Committee is still concerned about finding a permanent "Home" for the Society where adequate facilities may be available for conducting the growing work of administration.

Society's Medals Committee—A recommendation was made to Council that the Gold Medal of the Society be awarded to Mr. Cyril Oldtree Clark for outstanding services to the Society.

A Diploma expressing the thanks of the Council for services rendered by members of the various fastness committees has yet to be awarded, but now that the Coat of Arms is available this unavoidable delay will be rectified.

Worshipful Company of Dyers Research Medal Committee—The Council has recommended, in accordance with the decision of the Adjudicating Committee, that the Research Medal be awarded to Charles Lawrence Bird, M.Sc., F.R.I.C., F.S.D.C., as senior author of the series of papers on *The Dyeing of Acetate Rayon with Disperse Dyes*.

The recommended award has been approved by the Court of the Worshipful Company of Dyers.

Diplomas Committee—On the recommendation of the Committee, Council elected sixteen Associates following the 1956 examinations. The Committee gratefully acknowledges the co-operation of the technical colleges in providing suitable courses for the Society's Associateship examinations.

On the recommendation of the Committee eighteen Fellows were admitted during the year.

The Committee successfully assisted the Officers and Council in securing recognition for deferment by the Ministry of Labour and National Service, of students taking an approved course of training for the Society's Associateship examinations. Applicants for deferment are required to obtain a certificate from the Society to this effect.

The Examinations Board, appointed to organise and to conduct the Society's examinations, satisfactorily completed the holding of a further examination in June 1956. The services of the members of the Board are much appreciated.

Publications Committee—The past year has been a busy one for the Committee, but the only problem of outstanding importance has been that caused by the considerable increase in printing costs. Fortunately, owing to the increased revenue from increased advertising, it has not been necessary to curtail the scope of the *Journal*.

Textbooks and Monographs Subcommittee—The Subcommittee has in hand arrangements for publishing a set of laboratory notes and also for beginning publication of a series of short monographs on various branches of practical dyeing and printing.

Preservation of Historical Records Committee—A Japanese Scroll presented at the time of the Perkin Centenary Celebrations has now been handed over to this Committee.

COLOUR INDEX EDITORIAL PANEL—The members of the *Colour Index* Editorial Panel have had a very active year, at the end of which Volume I was issued. Volumes II, III, and IV are planned for 1957. The Society appreciates the patience of prepublication subscribers to the *Index* and this is shared by members of the Panel who, despite giving up many of their leisure hours, have found the task of producing the *Index* to be more time-consuming than originally anticipated.

Once again the Society records with pleasure the generous attitude of firms and associations who have continued to allow members of their staff to participate in the work. Members of the Panel are especially grateful for the help they have received from staffs of co-operating dye manufacturers in the revision of proofs and realise how valuable this work has been.

Co-operation with our partners, the American Association of Textile Chemists and Colorists, has been most active, as final proofs have had to be dealt with rapidly to meet the production schedule. This has called for considerable correspondence, and occasional differences in viewpoint could have been more rapidly resolved had direct discussions been possible, but, happily, all have been resolved without serious delay.

FASTNESS TESTS CO-ORDINATING COMMITTEE—The work of the Society on fastness tests has continued through the Co-ordinating Committee and its Subcommittees. During September a further conference of the International Organisation for Standardisation was held in New York, under the auspices of the American Standards Association. An account of this has been given in the *Journal* (December 1956), but briefly progress was made on the acceptance of tests on a world-wide basis. In two sections, however, viz. light and washing, America holds views which differ from those held in Europe and elsewhere, and so far it has not been possible to reconcile the two viewpoints.

Our Light Subcommittee has been active during the year in seeking to establish the most satisfactory conditions for the operation of fading lamps, and has published its recommendations in the *Journal* (August 1956) and elsewhere.

During the year the Committee has sponsored five papers in the *Journal*.

TERMS AND DEFINITIONS COMMITTEE—The Committee has continued to re-assess the list of definitions, on which it has been currently working, adding to the number as and when required. The work of reviewing is now almost complete and it is hoped shortly to submit to Council a complete list of the definitions, for which it was briefed. It will continue to define any subsequent terms submitted in the future.

REVIEW OF TEXTILE PROGRESS—The Joint Committee of the Society and the Textile Institute continues to be responsible for this publication, which maintains its level of demand.

THE SOCIETY AND THE TEXTILE INSTITUTE JOINT MOTHPROOFING COMMITTEE—Some few years ago it was decided that the first stage in the work of this Committee was to develop an acceptable larval test method. During the development of this work by the Joint Committee, it was found that the International Wool Textile Organisation was working on similar lines, and to avoid duplication the members of the S.D.C. and the T.I. Larval Test Committee have carried out their work jointly with the I.W.T.O. During the year the Tentative Specification, *Larval Testing of Mothproofed Wool Serge*, has been published by the I.W.T.O.

Representation on External Bodies

B.S.I. RAYON INDUSTRY STANDARDS COMMITTEE AND TEXTILE DIVISIONAL COUNCIL—Owing to the sudden death of Mr. C. P. Tattersfield on the 28th May, it was necessary to make new arrangements for the representation of the Society on the B.S.I. committees. The present representation confirmed by Council is Dr. H. A. Thomas on the Textile Divisional Council and Mr. C. C. Wilcock on the Rayon Industry Standards Committee.

Questions considered during 1956 and of particular interest to our Society, include the agreement at the International Standards Organisation committee meeting, May 15–18th, that work on waterproofness testing is to be initiated, in an attempt to achieve an internationally agreed method of testing and interpretation of the results of the test.

The setting up of performance standards for furnishing fabrics has raised a considerable number of problems, discussed in detail by the Rayon Industry Standards Committee, which, in conjunction with the Cotton Industry Standards Committee, set up a Technical Committee known as T. ch.–Cot.–1.

Agreement on an appropriate standard of colour fastness and of testing has not yet been achieved, the main difficulty being with regard to fastness to washing. The Textile Finishing Trades Association, supported by the Association of Piece Dyers, insist that the washing fastness of all-cotton, cotton-viscose rayon mixtures and all-viscose rayon fabrics should be tested by "Mechanical Wash Test B" (virtually a boiling test). This test is considered by many members of the Technical Committee to be much too severe and quite inappropriate to curtains. "Mechanical Wash Test A" (Grading 4–5) (washing at 60°c.) would seem to be a more appropriate test and would take cognisance of the fact that selected fast-to-light-and-washing direct dyestuffs continue to be entirely satisfactory for many casement shades. This applies particularly to dyed viscose rayon yarns in the coloured weaving of certain casement fabrics, and also to some piece-dyed fabrics.

B.S.I. STEERING COMMITTEE T/–/8—The Committee was responsible for the completion and issue of a second edition of B.S.I. Handbook No. 11 *Methods of Test for Textiles*, in which all the Society's fastness tests are given.

The Committee organised in June 1956 at Southport a conference of the full I.S.O. Technical Committee 38 at which many aspects of testing textiles were discussed.

Four meetings of the committee were held during the year.

City and Guilds of London Institute—Dyeing Advisory Committee—The Society is asked to notify the City and Guilds from time to time of any of the Society's publications which are considered suitable for students.

Regional Advisory Council for Technical and Other Forms of Further Education for Manchester and District—It has been decided to organise certain courses, of which the following are of interest to the Society—

1. Physical and Chemical Bases of Fibre Technology.
2. New Fibres in Blends (Problems in Finishing).

These are to be organised by Professor R. H. Peters.

B.S.I. Linen Industry Standards Committee—This Committee does not interest itself in dyeing, bleaching, or finishing, but the Society's representative holds a watching brief, despite the belief that any questions of fastness or quality can safely be left to the Linen Industry Research Association and this Society to deal with.

Royal Society—British National Committee for Chemistry—This Committee held a meeting on 20th July 1956, when a subcommittee was appointed to review the position of British representation on the section committees and commissions of the International Union of Pure and Applied Chemistry and to draft proposals to be put forward by the delegates to the Paris Conference (1957).

There was some discussion of the work of the Commission on Tables of Constants and Numerical Data, and its appeal for funds. It was recommended that the Union be asked to investigate the whole position.

A subcommittee was appointed to inspect the contributions from the United Kingdom to the International Congress of Pure and Applied Chemistry to be held in Paris in July 1957.

Note was taken of the issue in new form of the *Bulletin of Information* of the International Union of Pure and Applied Chemistry.

Society of Leather Trades Chemists—Committee for Fastness Properties of Dyes on Leather—This Committee in the course of its work has found it possible to accept several of the Society's fastness tests.

Royal Technical College, Salford—Applied Sciences Advisory Committee—Pending the arrival of a new Principal the question of providing facilities for dyeing in the proposed new building extensions is being held in abeyance.

Chemical Society—Joint Library Committee—The Committee met five times during the year and has reviewed the newly published works on chemistry and allied subjects. About 250 new works and journals have been added to the Library during the year; these additions will be of considerable interest and use to members of the Society.

During the year a physical reorganisation of the Library has been completed which should add considerably to the convenience of borrowers.

The Committee has also considered the disposal of about 1,000 volumes of duplicate and other works. In the main these books have been received by scientific and technical libraries.

Textile Institute—Technical Committee "D"—Main items considered were the quantitative separation of fibre blends such as viscose rayon–cotton; protein-non-protein fibres; nylon-wool-viscose rayon or cotton; method of test for the determination of resin content of textile materials treated with urea–formaldehyde resin; measurement of degree of carrotting of hatter's fur; and the removal of added matter from textiles.

Work is still continuing on the first item, but the method adopted for the determination of protein and non-protein fibre blends has now been published in Tentative Textile Standard No. 33. Nylon–wool–viscose rayon or –cotton blends are still under consideration; measurement of degree of carrotting of hatter's fur is in preparation as a Textile Standard, and the removal of added matter is ready for issue as a B.S.I. standard.

The following Committees report that there has been little or no business of special interest to the Society—

British Biological Stains Commission
British Standards Institution—
- Colour Terminology
- Cotton Industry Committee
- Electric Discharge Lamps
- Proofed Clothing—Dyeing and Finishing Processes Committee
- Rotproofing of Textiles other than Clothing
- Subcommittee and Panel on Standards for Anodic Oxidation Finishes for Aluminium and Aluminium Alloys
- Wash Fastness of Buttons
- Wool Industry Standards Committee

Textile Institute—Unification of Testing Methods Committee
Yorkshire Council for Further Education—County Advisory Committee for Textiles.

The Honorary Secretary (Mr. L. M. Wood), in proposing the adoption of the Annual Report, drew attention to the tremendous amount of voluntary work done on behalf of the Society without any reward. In his opinion here lay the strength of the Society.

In speaking of the *Journal*, Mr. Wood said that it was recognised as the premier publication of its type throughout the world. The Society was the inaugurator of the Perkin Centenary, and along with four other Societies organised the Perkin Trust Fund. On the subject of the new *Colour Index*, Mr. Wood said he considered it to be the biggest task the Society had ever undertaken, and it had needed a great deal of courage to undertake a project costing some £90,000. Volumes 1 and 2 had already been published, and Volumes 3 and 4 were nearing completion. He wished to take the opportunity of thanking all the people concerned for the time and trouble they had taken to complete this work, and also to thank their firms for allowing them time to undertake this project.

Balance Sheet as at 31 December 1956

31.12.55		SURPLUS AND LIABILITIES	£ s. d.	£ s. d.
		Accumulated Fund		
37,058		Balance 1st January 1956	38,182 13 5	
1,125	38,183	*Add* — Surplus for the year	501 17 10	38,684 11 3
1,851		**Foundation Fund**	1,850 13 0	
100		**Knecht Memorial Fund**	100 0 0	
2,000		**George Douglas Lecture Fund**	2,000 0 0	
266	4,217	**George Douglas Accumulated Income**	323 14 10	4,274 7 10
	120	**Subscriptions Received in Advance**		58 13 0
		Sundry Creditors and Provision for Miscellaneous Expenditure		
3,931		Society	2,953 18 4	
2,513	6,744	New Colour Index	635 10 4	3,589 8 8
	£49,264			£46,607 0 9

Colour Index (2nd Edition)
Note—

The agreement with the American Association of Textile Chemists and Colorists provides for an equal division of income and expenses relating to the above Index. At the date of this Balance Sheet any amount due to or from the Association is not ascertainable, and no provision has been made in these Accounts.

A. WADDINGTON *Honorary Treasurer*

L. MORTON WOOD *Honorary Secretary*

31.12.55		ASSETS	*Approx. Middle Market Value 31.12.56* £ s. d.	*At Cost* £ s. d.
		Accumulated Funds		
21,892		**Investments**	18,153 19 9	22,042 0 10
		Foundation Fund		
1,850		**Investments**	1,827 8 0	1,850 13 0
		Knecht Memorial Fund		
100		**Investments**	71 13 0	100 0 0
		George Douglas Lecture		
2,000	25,842	**Fund Investments**	1,354 2 0	2,000 0 0
			£21,407 2 9	25,992 13 10
35		**Cash in Hand**	78 3 10	
14,559		**Cash at Bank**	1,444 9 3	
4,983		**Debtors and Prepayments**	3,743 12 3	
1,901	21,478	**Stocks**	2,530 13 6	7,796 18 10
		Colour Index (2nd Edition) Account		
		Expenditure incurred on Printing and Publishing		
17,177		to date	34,136 1 11	
160		Colour Index Furniture	157 0 0	
17,337			34,293 1 11	
17,100	237	*Less* — Prepayments Received	23,728 18 11	10,564 3 0
	197	**Perkin Centenary Account**		366 15 8
		Furniture and Equipment		
75		**Library**	68 0 0	
1,235	1,310	**General Office**	1,484 0 0	1,552 0 0
	100	**Library (At Nominal Valuation)**		100 0 0
	—	**Coat of Arms**		234 9 5
	£49,264			£46,607 0 9

AUDITORS' REPORT

We have examined the above Balance Sheet with the Books and Documents of the Society produced to us. In our opinion the above Balance Sheet is properly drawn up so as to exhibit a true and fair view of the state of the Society's affairs according to the best of our information and the explanations given to us and as shown by the Books of the Society.

RAWLINSON, GREAVES & MITCHELL
Chartered Accountants
Auditors

Bradford
11 February 1957

Consolidated General Revenue Account

for the Year ending 31 December 1956

31.12.55	EXPENDITURE	£ s. d.	£ s. d.
5,793	Salaries, Wages, National Insurance and Honoraria	8,466 3 7	
651	Rent, Rates and Insurance	786 7 2	
89	Electricity and Heating	131 6 6	
198	Telephone	385 11 9	
1,131	Printing and Stationery	1,083 10 9	
758	Postages	1,382 6 1	
146	Hire of Rooms for Council, Committees, Sections and Conferences, etc.	97 13 0	
132	Travelling and Hotel Charges	254 18 3	
—	National Deferment Expenses	33 13 4	
168	Incidental Office Costs	236 3 11	
129	Depreciation of Office Furniture and Equipment	114 19 2	
37	Bank Charges	53 4 4	
180	Audit	180 0 0	
126	Repairs and Renewals	135 11 6	
81	Medals, Prizes and Illuminated Addresses	184 8 2	
34	Donations and Subscriptions	15 0 4	
124	Unpaid Accounts — Provisions and Amounts Written Off	— — —	
(Cr.) 182	Diploma Costs (Less Fees)	70 11 3	
866	Sectional Costs	1,354 5 2	
11	Mercer Lecture Costs	108 3 8	
10,266	Printing and Publishing Journal	12,119 12 10	
84	Publication Committee Expenses	73 16 10	
—	Excess of Expenditure over Income on Sales of Publications	90 3 3	
341	Abstractors' Fees and Book Reviews	289 5 6	
2,708	Printing and Publishing Colour Index	9,682 7 1	
56	Advertising — Colour Index	449 18 0	
92	Expenses incurred but not allowable per Agreement with A.A.T.C.C.	187 13 9	
28	Storage Sundries — Colour Index	12 10 4	
—	U.S. Colour Index Shipment Expenses	341 15 2	
81	Annual Meeting and Dinner	160 18 10	
—	Buxton Symposium	16 16 3	
—	International Federation Congress 1959	121 1 8	
23	Library Upkeep	— — —	
49	Historical Records Committee Expenditure	— — —	
236	Special Service Accountancy Charges	— — —	
1,125	Net Surplus for the Twelve Months	501 17 10	
£25,561		£39,121 16 0	

31.12.55	INCOME	£ s. d.	£ s. d.
7,344	Membership Subscriptions	7,659 14 11	
	Journal		
11,665	Sale of Journals, Reprints, Combined Reports, Advertisements etc., as adjusted for Opening and Closing Stock	15,384 8 6	
676	Investment Income (Gross)	683 3 4	
84	Interest on Bank Deposit Account	124 18 6	
1,118	Balance of Account "Fastness Tests"	674 14 2	
171	Donations	10 10 0	
—	Bad Debts Reserve Written Back and Amounts Recovered	254 18 11	
4,503	Transfer to Colour Index Account	14,329 7 8	
£25,561		£39,121 16 0	

COLOUR INDEX (SECOND EDITION) ACCOUNT FOR THE YEAR ENDING 31 DECEMBER 1956

31.12.55		£ s. d.	£ s. d.
1,047	Work in Progress 1.1.56		2,770 0 0
	Expenses		
	Wages and National Health Insurance	2,466 12 11	
1,092	Printing and Publishing	9,682 7 1	
2,708	Printing, Stationery, Advertising and Postages	1,126 5 4	
292	Travelling	100 0 0	
—	Telephone	128 10 7	
36	Electricity and Heating	43 15 6	
17	Storage and Sundries	12 10 4	
28	Rent, Rates and Insurance	262 2 5	
203	Audit and Accountancy	30 0 0	
30	Bank Charges	19 6 1	
6	Repairs and Renewals	45 3 10	
41	Cleaning and General Office Expenses	70 18 5	
50	U.S. Colour Index Dispatch Expenses	341 15 2	14,329 7 8
—			
£5,550			£17,099 7 8

31.12.55		£ s. d.
2,770	Work in Progress	
	Investment Income	
157	Midland Bank Ltd. Deposit Account	139 13 3
2,623	Balance carried to Colour Index Accumulations Account	16,959 14 5
£5,550		£17,099 7 8

COLOUR INDEX (SECOND EDITION) ACCUMULATIONS ACCOUNT

		£ s. d.	£ s. d.
14,553	Accumulated Total at 1.1.56	17,176 7 6	
2,623	Balance brought forward being Excess of Expenditure over Income for the year	16,959 14 5	
£17,176		£34,136 1 11	

		£ s. d.
17,176	Accumulated Total at 31.12.56	34,136 1 11
£17,176		£34,136 1 11

GEORGE DOUGLAS ACCUMULATION FUND ACCOUNT

		£ s. d.			£ s. d.
—	**Lecture Expenses**	— — —		**Balance** per Accumulated Income Account 1.1.56	266 4 8
2	**Bank Charges**	2 0 0	209	**Investment Income (Gross)**	
266	**Balance** per Accumulated Income Account 31.12.56	323 14 10	59	3% British Transport Stock 1978/88	59 10 2
£268		£325 14 10	£268		£325 14 10

GEORGE DOUGLAS LECTURE FUND

£1,983 17s. 3% British Transport Stock 1978/88	*£2,000 0 0*	£2,000 0 0	*£1,460 13 2*	£1,354 2 0	68¼

KNECHT MEMORIAL FUND

£98 16s. 6d. 3% Southern Rhodesia 1971/73	*£100 0 0*	£100 0 0	*£75 12 0*	£71 13 0	72¼

SCHEDULE OF FOUNDATION FUND ACCOUNT INVESTMENTS

	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
1,245 2½% Defence Bonds	*1,245 0 0*	1,245 0 0	*1,245 0 0*	1,245 0 0	—
1,000 National Savings Certificates 10s. Units 8th Issue	*500 0 0*	500 0 0	*500 0 0*	500 0 0	—
£68 8s. 6d. 3% Savings Bonds 1960/70	*69 9 0*	69 9 0	*55 0 2*	53 7 0	78
£37 9s. 3d. Treasury 5½% Stock 1979/81	*36 4 6*	36 4 6	*30 12 6*	29 1 0	77½
	£1,850 13 6	£1,850 13 0	*£1,830 12 8*	£1,827 8 0	

SCHEDULE OF DEVELOPMENT ACCOUNT INVESTMENTS

	Balance 1955	*Alterations*	*Balance 1956*	*Middle Market Value 1955*	*Middle Market Value 1956*	*Middle Market Quotation*
	£ s. d.		£ s. d.	£ s. d.	£ s. d.	
£2,763 3s. 6d. 3% British Transport Guaranteed Stock 1978/88	*2,598 17 6*		2,598 17 0	*2,034 7 10*	1,886 17 0	68¼
£750 2½% Funding Stock 1956/61	*750 0 0*		750 0 0	*675 0 0*	679 14 0	90⅝
£546 3½% Conversion Loan	*557 0 0*		557 0 0	*407 9 1*	386 6 0	70½
£255 2½% Defence Bonds	*255 0 0*		255 0 0	*255 0 0*	255 0 0	—
£2,749 16s. 0d. 3% Savings Bonds 1960/70	*2,750 0 0*		2,750 0 0	*2,213 11 10*	2,144 17 0	78
£750 3% Funding Stock 1966/68	*750 0 0*		750 0 0	*616 0 0*	600 18 0	80¼
500 National Savings Certificates 15s. Units 7th Issue	*375 0 0*		375 0 0	*375 0 0*	375 0 0	—
£2,000 3% British Gas Stock 1990/95	*2,000 0 0*		2,000 0 0	*1,430 0 0*	1,357 10 0	67¾
£2,017 11s. 6d. 3% Treasury Stock 1966 or after	*1,957 1 0*		1,957 1 0	*1,311 8 6*	1,250 18 0	62
£901 3s. 6d. 3% Southern Rhodesian 1971/73	*910 13 9*		910 13 9	*659 5 0*	725 0 0	72¼
York County Savings Bank	*4,196 3 3*	Interest credited during the year £115 8s. 2d. Defence Bonds Interest credited during the year £7 14s. 0d.	4,319 5 5	*4,196 3 3*	4,319 5 5	—
£1,500 12s. 9d. 3% British Electricity Guaranteed Stock 1968/73	*1,495 19 6*		1,495 19 0	*1,183 12 7*	1,127 7 0	75¼
Post Office Savings Bank	*1,075 19 2*	Interest credited during the year £26 7s. 2d.	1,102 6 4	*1,075 19 2*	1,102 6 4	—
£1,000 Chesterfield Corporation 3% Stock 1960	*993 15 0*		993 15 0	*900 0 0*	920 0 0	92
£1,037 17s. 3d. Treasury 3½% Stock 1979/81	*1,007 3 4*		1,007 3 4	*844 11 3*	803 1 0	77½
£220 3½% Defence Bonds	*220 0 0*		220 0 0	*220 0 0*	220 0 0	—
Note — The Deposit Account at the Midland Bank Ltd., previously included in this total of Development Account Investments (£3,662 in 1955) has now been grouped under the item "Cash at Bank".						
	£21,892 11 6		£22,042 0 10	*£18,426 11 6*	£18,153 19 9	

Mr. Wood did not think that it was generally realised that the Society had members in practically every civilised country throughout the world, and this offered great scope. The membership of the Society was increasing annually, which was some indication of the Society's standing amongst technologists. He did not, however, wish members to be complacent, and urged them to encourage suitable people to join the Society.

It had been gratifying to obtain recognition from the Ministry of Labour and National Service of the Society's Associateship as a qualification training for which would be regarded as grounds for deferment of National Service.

Mr. Wood drew attention to the forthcoming Mercer Lecture in Leicester, the Symposium in Buxton in September, and the fact that next year's Annual General Meeting would be held in Scotland, 1958 being the Jubilee Year of the Scottish Section.

In conclusion, Mr. Wood thanked the General Secretary, Mr. J. W. Nicholls, the Editor, Dr. C. J. W. Hooper, and the staff for the conscientious way in which they had looked after the affairs of the Society.

Mr. J. BOULTON seconded the adoption of the Report and said that it was a very long time since the Society could report such intense activity and such a high degree of achievement as was recorded in the 1956 Annual Report.

The motion was carried.

On the question of deferment, the President told the Meeting how impressed and encouraged he had been, in his dealings with the Ministry of Labour, to find what a very high standing the Society holds outside its immediate members. He also stated how indebted the delegation to the Ministry had been for the help given by Dr. R. L. Elliott.

ANNUAL ACCOUNTS

The Honorary Treasurer (Mr. A. WADDINGTON), in moving the adoption of the Balance Sheet and Statement of Accounts, said that members would have noticed a slight difference from previous years, when apportionments had been made between the General Fund, the *Journal* Fund, and other separate funds. In view of changing conditions this method was not very satisfactory and could lead to a false interpretation of individual accounts. The matter had been discussed with the Auditors, who had welcomed the suggestion of presenting Consolidated Revenue Accounts.

Members would no doubt have noticed a reduction in the surplus of income over expenditure. The largest item contributing to this was a substantial rise in printing costs for the *Journal*, which had taken place in June. Advertising rates had been advanced, but as many advertisers had contracts there was inevitably a time lag between increased costs and increased receipts. The accounts for 1957 would be more normal in that respect.

Mr. Waddington supported the appeal of the Honorary Secretary for increased membership, as this would assist in maintaining the present rate of subscription, but he assured members that, although the surplus had been reduced, it would only be in the very last resort that subscriptions would be increased, and he did not see any necessity for taking this step in 1957. The Council and the Finance Committee were making all possible economies, but care must be taken not to impair efficiency.

The financing of the new *Colour Index* might mean the realisation of some investments, but not, it was hoped, to any large extent. It would be noted that the market prices of investments were still much below the balance-sheet values, but as it was not expected that any substantial realisations would have to be made, the losses on paper would automatically right themselves, since most of the investments had a fixed redemption date.

Mr. J. W. REIDY seconded, and the adoption of the Balance Sheet and Accounts was carried unanimously.

AMENDMENT TO BYE-LAW 22

The President said that this resolution had been defeated at the last Annual General Meeting. Mr. Fred Smith, who had been President at that time, had said that the matter would be brought up again by Council at another Annual General Meeting or at an Extraordinary General Meeting. This question had now been fully discussed in Council, the principles underlying the resolution having been thoroughly debated, and it was thought to be in the best interests of the Society that the amended bye-law, in a simpler form than last year, should be passed. The present proposed bye-law differed from the existing bye-law in two ways.

The first difference was that the Perkin Trustee was included, this having been agreed at the previous Annual General Meeting.

The second and main difference was the inclusion of the words "Three Past-presidents" with the definition: "The Three Past-presidents shall comprise the Immediate Past-president and the two Past-presidents immediately preceding him in the Presidential office".

Mr. R. K. FOURNESS, in proposing the adoption of the motion, said that it would mean an addition of three to the thirty-eight members of Council, but these three would be men whose proved ability in serving the Society would be of inestimable value.

Mr. G. G. HOPKINSON seconded the motion and stated that he felt very strongly indeed that the Society must not lose the vast experience which these Past Presidents could bring to the Council. It was most unsatisfactory for Past Presidents to disappear so quickly from the counsels of the Society.

Mr. H. À BRASSARD raised the question of seniority of Past Presidents in Council, and the question of their future service to the Society. He argued that a Past President should maintain that status, and not be relegated to be an Ordinary Member of Council or a Vice-president.

The President explained that there was no question of seniority in Council. All members were equal in both discussion and voting, the only exception being the deciding vote of the Chairman.

The standing of Past Presidents and their distinguished service in the Society were quite a separate matter.

Mr. A. W. CARPENTER enquired as to the position should one of the three immediate Past Presidents be deceased.

The President said that there could only be three immediate Past Presidents, and should one die, then only two would serve.

Replying to a question from Dr. H. W. ELLIS as to whether the amendment was intended to be retrospective, the President thought that the simplest way of dealing with the matter was for the immediate Past President and two preceding Past Presidents to serve. Dr. Ellis pointed out that one of these had died.

Mr. J. BARRITT proposed an amendment by inserting the word *surviving* between "two" and "Past-presidents" in the definition; and this was seconded by Mr. A. W. CARPENTER.

Mr. FRED SMITH spoke in favour of the amendment and stressed the importance of continuity in the Council.

The amendment was carried by 35 votes for and 17 votes against.

The Resolution as amended, reading—

The Council shall consist of—
- The President
- The President-elect
- Three Past-presidents
- Six Vice-presidents
- Twelve Ordinary Members
- The Perkin Trustee
- The Honorary Treasurer
- The Honorary Secretary
- The Chairmen of Local Sections
- The Honorary Secretaries of Local Sections
- The Chairman of the Publications Committee.

The three Past-presidents shall comprise the Immediate Past-president and the two surviving Past-presidents immediately preceding him in the Presidential office.

was carried unanimously.

RE-ELECTION OF PRESIDENT

Dr. C. M. WHITTAKER, in proposing the re-election of Mr. Clifford Paine as President, said that he had conducted the Society through the very important Perkin Centenary year, and had filled the office to the entire satisfaction of every member of the Society. Mr. Paine had represented the Society at the Perkin Centennial celebrations in New York, and he had given one of the four outstanding Centenary lectures at the Royal Institution in London. It was inevitable that the second year of office could not be quite so eventful as the first year, but it would be marked by the publication of the Second Edition of the *Colour Index*. He wished Mr. Paine every success in his second year of office.

Mr. FRED SMITH congratulated Mr. Paine on the way in which he had conducted meetings, and seconded the motion, which was carried with acclamation.

Mr. CLIFFORD PAINE, replying, said that it was an even greater honour to be re-elected than to be elected in the first instance. It would be his very sincere intention to serve the Society to the utmost of his ability, and to try to justify the trust which they had placed in him.

ELECTION OF PRESIDENT-ELECT

Mr. G. S. J. WHITE, in proposing the election of Mr. John Boulton as President-elect, said that Mr. Boulton was a pioneer in the better understanding of the physical chemistry of dyeing, and his name had appeared on contributions to the *Journal* from the early 1930s up to the present time. The standing of the Society from both academic and technological standpoints owed much to Mr. Boulton. He had been a member of the Council and of many committees of the Society, and the excellent and outstanding work done by Mr. Boulton on the Fastness Tests Co-ordinating Committee was especially worthy of mention. He was Chairman of the Manchester Section of the Society and held a high office in the Textile Institute. Mr. Boulton's many connections with similar societies abroad were particularly valuable.

Mr. H. HAMPSON seconded the motion, which was carried with acclamation.

Mr. J. BOULTON expressed his thanks for the honour which had been accorded to him, and promised to do his best to fill the office adequately. He intended to learn from the distinguished work of Mr. Paine and of Mr. Fred Smith, and to come out of his apprenticeship better equipped for the office ahead.

ELECTION OF ONE VICE-PRESIDENT

The President explained that there had been only one nomination, duly supported, for this vacancy, and therefore Mr. Richard Charles Oakley, a member of the London Section and a former High Sheriff of the County of Bedfordshire, would be elected.

Mr. R. C. OAKLEY suitably replied.

ELECTION OF FIVE ORDINARY MEMBERS OF COUNCIL

The President pointed out that, in view of the Resolution just passed, Mr. Fred Smith would serve on Council as a Past President, and the result of the ballot was therefore as follows— Dr. G. T. Douglas, Mr. F. Farrington, Mr. N. Hamer, and Dr. L. Peters elected to serve for three years; Dr. A. Datyner to serve for two years.

The President expressed the thanks of himself and Council to the retiring Vice-president (Mr. G. G. Hopkinson), who had done very excellent service on the Council in that capacity, and also to the three retiring Ordinary Members of Council (Messrs. A. S. Fern, H. Hampson, and J. W. Reidy).

RE-ELECTION OF HONORARY SECRETARY

The re-election of Mr. L. Morton Wood as Honorary Secretary was proposed from the Chair, and the President emphasised the great amount of work done by Mr. Wood on behalf of the Society.

Mr. F. FARRINGTON seconded the proposition, which was carried unanimously, and Mr. L. M. Wood suitably replied.

RE-ELECTION OF HONORARY TREASURER

In proposing from the Chair the re-election of Mr. A. Waddington, the President stressed the wealth of knowledge and experience which Mr. Waddington brought to the deliberations of the Council, and of the Finance and General Purposes Committee. Mr. A. S. FERN seconded, and the motion was carried unanimously.

Mr. A. WADDINGTON suitably replied.

APPOINTMENT OF AUDITORS

The Honorary Treasurer proposed and Mr. J. V. SUMMERSGILL seconded the re-appointment of Messrs. Rawlinson, Greaves & Mitchell, and this was carried unanimously.

The President added his thanks to those of Mr. Waddington for the excellent service given during the year by Messrs. Rawlinson, Greaves & Mitchell.

THANKS TO SCRUTINEER

Thanks were expressed to Mr. R. Grice for his help with the counting of the votes.

VOTE OF THANKS TO THE PRESIDENT

Mr. J. W. REIDY proposed a vote of thanks to the President, and said how much his good humour, kindliness, and patience were appreciated. Mr. Paine had worked extremely hard on behalf of the Society, and he thanked him very much for his conduct of the Meeting.

The vote of thanks was seconded by Mr. C. L. BIRD and acclaimed by the Meeting.

Annual Dinner

The Seventy-third Annual Dinner of the Society was held at Grosvenor House, Park Lane, London, on Friday evening, 29th March 1957, under the presidency of Mr. Clifford Paine.

The principal guest was The Right Honourable Lord Milner of Leeds, P.C., M.C., T.D., D.L., LL.B., Hon. LL.D. Among other guests were Mr. H. B. Sissmore (*Prime Warden of the Worshipful Company of Dyers*), Sir Robert Robinson (*Chairman of the Perkin Centenary Celebration* and *Honorary Member of the Society*), Mr. James A. Frere (*Chester Herald of Arms*), Sir David Brunt (*Honorary Secretary of the Royal Society*), Sir Ernest Goodale (*President of the British Colour Council*), Professor W. Wardlaw (*Immediate Past President of the Chemical Society*), Professor Harold Burton (*Honorary Treasurer of the Royal Institute of Chemistry*), Mr. W. English (*Vice-president of the Textile Institute*), Dr. R. W. Holland (*President of the Royal Society of Arts*), Mr. C. W. A. Mundy (*President of the Oil and Colour Chemists Association*), Mr. B. Hickson (*Vice-chairman of the Association of British Chemical Manufacturers*), Mr. C. G. Hulse (*Secretary of the Dyestuffs Control, Board of Trade*), Mr. D. R. Balfour Park (*Clerk of the Worshipful Company of Dyers*), Mr. J. R. Ruck-Keene (*General Secretary of the Chemical Society* and *Secretary of the Perkin Centenary Fund*), Dr. D. C. Martin (*Assistant Secretary of the Royal Society*), Dr. H. J. T. Ellingham (*Secretary and Registrar of the Royal Institute of Chemistry*), Mr. D. B. Moore (*General Secretary of the Textile Institute*), Mr. K. W. Luckhurst (*Secretary of the Royal Society of Arts*), Mr. J. Davidson Pratt (*Director of the Association of British Chemical Manufacturers*), Mr. G. R. Taylor (*Director of the Textile Finishing Trades Association*), Mr. L. E. Morris (*Editor of "The Dyer"*), Mr. G. W. Bednall, Dr. J. L. Bolland, Mr. G. H. Carnall, Mr. R. D. Chorley, Mr. H. Clayton, Mr. J. G. Evans, Mr. Edgar Isles, Mr. C. F. Jacottet, Mr. H. R. Mathys, The Hon. Michael Milner, Mr. G. B. Ratcliffe, Mr. L. Savage, Mr. H. Wiles, Mr. L. E. Jones (*Honorary Patent Agent*), Mr. Fred Smith (*Immediate Past President and Honorary Member of the Society*), Mr. C. O. Clark (*awarded* (1956) *the Society's Gold Medal*), Mr. C. L. Bird (*awarded* (1956) *the Worshipful Company of Dyers Research Medal* and *Chairman of the Publications Committee*), and Dr. H. W. Ellis (*Chairman of the London Section*).

The following officers and other leading members of the Society also were present—Dr. C. J. T. Cronshaw and Dr. C. M. Whittaker (*Honorary Members and Past Presidents*); Mr. H. H. Bowen (*Past President*); Mr. J. Barritt (*Honorary Member* and *Chairman of the "Colour Index" Editorial Panel*); Mr. J. Boulton (*President-elect*); Mr. R. J. Hannay, Mr. R. C. Oakley, Mr. W. Penn, and Mr. G. S. J. White (*Vice-presidents*); Mr. A. S. Cluley, Dr. G. T. Douglas, Mr. F. Farrington, Mr. R. K. Fourness, and Dr. T. Vickerstaff (*Ordinary Members of Council*); Mr. F. Atack, Mr. H. Boothroyd, Mr. A. W. Carpenter, Mr. C. W. Green, Mr. W. J. Macnab, Mr. W. R. Mathers, Mr. J. Porter, Miss Esmée Smith, Mr. H. W. Taylor, and Mr. H. Turner (*ex-officio Members of Council*); Mr. K. Meldrum, Mr. R. A. Peel, and Mr. D. T. Young (*Junior Branch Officers*); Mr. J. V. Summersgill (*Honorary Secretary of the Publications Committee*); Dr. P. W. Cunliffe (*Chairman of the Fastness Tests Co-ordinating Committee*); Mr. J. W. Reidy (*Chairman of the Finance and General Purposes Committee*); Mr. L. M. Wood (*Honorary Secretary*); and Mr. A. Waddington (*Honorary Treasurer*).

The total number of diners was 370.

AWARDS

After the toast of "Her Majesty the Queen", it was announced that the Research Medal of the Worshipful Company of Dyers for 1955–1956 had been awarded to Mr. C. L. Bird.

The President then presented the Diploma of Honorary Membership of the Society to Mr. Fred Smith, and the Gold Medal of the Society to Mr. C. O. Clark.

"THE SOCIETY OF DYERS AND COLOURISTS"

The Right Honourable Lord MILNER OF LEEDS, P.C., M.C., T.D., D.L., LL.B., Hon. LL.D., said that he was greatly honoured to be invited as the

Society's guest and to enjoy such generous hospitality. He was additionally honoured in being invited to propose the toast of the Society, although he would say that, after some twenty odd years in the House of Commons, a good many years in one of the Chairs in that House, and having heard some thousands of speeches, he had come to the same conclusion as Confucius had come to some four thousand years ago, that on many occasions it is better to keep one's mouth closed and be thought a fool than to open it and remove all doubt.

He had gathered, however, that one of the reasons for the kind invitation to be present and to propose the toast of the Society was that he had the honour at the moment to be President of the Society of Yorkshiremen in London. Mr. Paine was a Yorkshireman from Leeds, and so he felt, if he might say so in the presence of so many Lancastrians, that it was almost a Yorkshire occasion. Lord Milner wished to say a quiet word to the President on this matter. A man who had the great advantage of being born in Yorkshire, but who had chosen to spend the greater part of his life in Lancashire, would not, he very much doubted, qualify to remain on the higher plane. However, in the case of the President there were a great many redeeming features. He had over a period of years not only travelled a great deal, but rendered in the realms of science and research a great many services, not only to this country and to industry, but to Yorkshire with its textile trade in particular. He thought that on that account the President might be given favourable consideration.

Lord Milner said that Mr. Paine had been telling him something of his travels during recent years, and particularly of his visit to the United States. Lord Milner thought that to businessmen, scientists, and politicians a visit to the United States was today almost a prerequisite for the highest office. Many people, in making these visits, were far too modest, and he hoped that the President had taken the opportunity of stressing what our country stood for. A result of his own frank speaking in Texas was that he had been made an honorary citizen, and was now entitled to wear a ten-gallon hat and to speak with a Texan drawl: he did not doubt that such an honour would come the President's way before long.

Having read the Society's Annual Report, which covered a vast range of activities, Lord Milner wished to pay a very high tribute indeed to his hosts, the officers of the Society and its members. The Society's main object, as laid down at the first meeting over seventy years ago— to unite scientific theory with practical application— was as valid today as it was then, and appeared to have been largely achieved.

It was common form nowadays to lay stress on the grave shortage of scientists and technically trained men and women, but there was still a great deal of hope in that matter. The country was waking up to the need for technical and scientific training and education, supported as it was now by Governments of all shades of colour, by universities, technical institutions, both public and private, and even by correspondence schools, with one of which he had some association. Courses were becoming more attractive, and in time we should have the results which were essential to our survival as a great industrial nation. It was a good thing that the Society, and not least its President, had played and were playing a great part in this training.

Though it was perhaps outside the province of the occasion and of the Society, Lord Milner wished that relations between workpeople and management in the various industries in the country gave equal grounds for hope. It had regrettably to be admitted that in some industries there was a gap, a lack of understanding or absence of co-operation, between what were called the two sides of industry. There should not be two sides: there should be only one. Employees were entitled to a fair proportion of the products of their labour, based as it should be on full knowledge, consultation, and co-operation throughout; and in turn employers and executives were entitled to expect employees to pull their full and enthusiastic weight in productivity. All should remember that the welfare of the country as a whole was at stake, and there were in this country processes of democratic discussion and negotiation which were unparalleled anywhere else in the world, and of which full advantage should be taken before crises arose. He thought that the dyeing industry had been commendably free from disputes, and he hoped that that state of affairs would long continue. We claimed to be a free country, as indeed we were compared with a great many others, but there were degrees of freedom and some were quite illusory.

The industry had made an immense contribution to the colour, and beauty, and the welfare of the human race, and its ramifications seemed to be tremendous. There was no limit to what had been and could be done to make life both more civilised and happier, and to keep our country in the foreground of invention and research. The industry was thereby fortifying his belief that, notwithstanding our difficulties, we should surmount them and continue to lead the world in the arts of which the President and members of the Society were masters, and in which the Society could and, he had no doubt, would play a great part in the future. He had the greatest pleasure in proposing the toast of the Society of Dyers and Colourists and coupling it with the name of the President, Mr. Clifford Paine.

Mr. Clifford Paine, B.Sc., F.R.I.C., F.S.D.C. (*President of the Society*), in replying to the toast said that Lord Milner had emphasised the fact that he had been born in Yorkshire and, like many an errant Scotsman, earned his living in Lancashire. He had also been for many years a citizen of the ancient County of Chester, so that in the presence of the Chester Herald it would ill become him to exacerbate further the Wars of the Roses, even in the presence of the Honorary Deputy Sheriff of Texas.

The Society had that afternoon elected a President-elect in the person of Mr. John Boulton, who had proposed to sit at Mr. Paine's feet for the next year in order to learn what it was all about. The President considered that nothing could be

Fred Smith
F.S.D.C.

Honorary Membership in recognition of long and devoted services to the Society

Cyril Oldtree Clark
F.T.I., F.S.D.C.

Gold Medal in recognition of outstanding services to the Society

Charles Lawrence Bird
M.Sc., F.R.I.C., F.S.D.C.

Worshipful Company of Dyers Research Medal for 1955–1956 as senior author of the series of papers on *The Dyeing of Acetate Rayon with Disperse Dyes*

パーキン一〇〇年祭に際し日本化学会を代表して心からなるお祝の言葉を述べます

現代の有機合成化学はにその工業の絢爛豪華なることは科学の底知れぬ可能性を示すと共に一人の偉人の鴻業に思を致さねわけにはいきません　ウィリアム・ヘンリー・パーキン卿の一〇〇年前に於けるモーブの発見は単に染料という分野の誕生に止まらず　有機化学の半ばを占める芳香族化学の偉大な発展を齎したものであり　又其後につづく脂肪族化学への慈み深き母体化学としてその栄誉の不滅なることを信じて疑いません　殊に純粋化学と工業化学との渾然一体なる一〇〇年の成果は　洵に我れわれ人類に福祉と健安を與え　更に進展発躍する未来の科学への努力に希望と勇気を附與するものであります

かくて　パーキンの一〇〇年祭は洵に意味深いものでありまして全世界の化学者は科学者と共に卿の偉業を偲びつつ益々世界の平和と人類の幸福に盡したいと思っております

一〇〇年祭の盛なる事を遥にお祈り致します

昭和三十一年四月　日

日本化学会会長　井上春成

Scroll conveying Greetings from the Japan Chemical Association to the Perkin Centenary (see p. 329)

better than to start the lesson at the present Annual Dinner, where one of the more onerous duties of the President was to find some ready and appropriate response to the witty and eloquent speakers who proposed the toast of the Society. At the Annual Dinner last year that witty Irishman, the Right Honourable G. B. Hanna, then Minister of Finance in Northern Ireland, was the speaker. He had since been created a learned Judge. Lord Milner, too, had some considerable knowledge and practice of the Law, and he too, with his own salty wit, wisdom, and commonsense, had given his own seal to the toast. During the dinner, seated on Lord Milner's left, Mr. Paine had realised that it was only since becoming President that he had had any difficulty in keeping on the right side of the Law, at least at dinner. Of course, as a chemist he had always been interested in natural law rather than the unnatural variety.

He appreciated that the kind things which Lord Milner had said about him personally must have meant a great deal of detailed research. In contrast, Lord Milner's distinguished career was, so to speak, an open book, at least an open *Who's Who*, and from the long list of his achievements it was amazing that he had any time left at all for activities under the heading of "recreation".

The year of foundation of our Society, 1884, was that in which Chardonnet was producing his first somewhat unsatisfactory artificial silk. The Castner–Kellner electrolytic process for caustic soda and cheap chlorine, so important for the bleaching industry, began the following year. The incandescent gas mantle was still two years ahead. The Dunlop pneumatic tyre emerged five years later, in 1889.

It was worth recalling that in the brief space of six years around 1880 three important scientific organisations were founded—the Institute, now the Royal Institute, of Chemistry, the Society of Chemical Industry, and the Society of Dyers and Colourists. The President regretted that because of illness the President of the Society of Chemical Industry was not able to be present.

The birth of these three societies in such a short space of time was the expression of the growing need to bring pure and applied science into proper relation to the industrial context at a time when there was a great fermentation of new ideas. The pioneers who founded our own Society for the purpose of promoting scientific and technical knowledge among textile colourists were well aware of this. They had a clear appreciation of the rapid technical changes taking place in their industry as a result of the crescendo of synthetic dyes. The epoch-making Congo Red was introduced in the year of the Society's foundation.

It was equally important that amongst the Society's founder members were businessmen who foresaw the rising industrial and commercial strength of their European competitors in industries newly fostered by applied science. They rightly assumed that, unless there were an appropriate infusion of new scientific and technological ideas into the art of the British textile colourist, an important part of our trade could not face up to international competition. Today problems very similar in kind but much greater in intensity are found. This, too, is a time of rapidly changing technology. Only the most rigorous application of scientific methods can give us the efficiency and quality in production which are so vital to the country's export business and to its national survival.

There are those who fear the coming into being of the European Common Market. There are those who would have this country stand aloof from any association with it or with a European free-trade area. It is quite certain that we cannot afford to stand aloof. We must face squarely the competitive implications of this new concept, and sharpen our skills and our natural ingenuity to that end.

In this modern context the principles on which our Society was founded are more important than ever. As a Society we are capable of making still greater contributions to the technical strength of those industries concerned with the production and use of colour. We are proud, and rightly so, of the scientific quality of our *Journal*. That quality is recognised internationally. We must not be content to let the world admire and apply our scientific work: we must ensure that the new knowledge we generate in Britain is first utilised quickly in our own industry and in the training of our young technologists.

A name well known in this assembly is that of the late Sir James Morton—a man who began life in the textile industry, later became interested in dyeing and high standards of fastness in dyeing, and ultimately created a dye-manufacturing business to ensure the requisite standards in his dyeings. Morton was a man of remarkable industrial ability. He had wisdom and great qualities of leadership. In one of his early writings, a pamphlet entitled *Advice to Young Weavers*, he wrote: "Let us seek out the things to do that are difficult. That is where there is lots of room and where you can least be followed." There could be no more appropriate slogan for our Society than that. The fact that it was coined by a textile man who was both dyer and dyemaker makes it all the more appropriate.

In attempting the difficult things there will always be the sceptics at our elbow and the wits prepared to make fun at our expense, like the man who said to Bosch, the great German chemist: "Bosch, I know you can make indigo cheaper than God. You may some day make rubber cheaper than God, but you will never make cellulose cheaper than God." This must have sounded witty at the time, but it has a slightly false ring nowadays. The scientist is now finding substances which influence the rate of growth of plants and which may yet cheapen or improve God's cellulose. The new man-made fibres have created many new problems of dyeing and printing, and it is fitting that the Society should make this the subject for its scientific and technical symposium in a few months' time.

Since our last Annual Dinner the Society has been granted arms by letters patent from the

Kings of Arms. We are very happy that we have Mr. James A. Frere, the Chester Herald of Arms, with us as a guest tonight, for it gives us the opportunity of expressing our thanks to him for the helpful way in which he has dealt with our application for the grant of arms. The Letters Patent are displayed here this evening, and the Coat of Arms* is reproduced in miniature on the menu cards. There must be many Latin scholars present capable of a more precise translation of the Society's new motto—*Scientia coloris ministra*—than "Science in the service of coloration". It sums up effectively what our Society has stood for since its inception. The left-hand supporter of the shield in the Coat of Arms represents the goddess Iris, a messenger of the gods. Her symbol was also a rainbow, representing the path which she traversed in carrying out the messages of the gods. Those who matriculated in the right year will remember that she appears in a scene in Shakespeare's play *The Tempest*. There she is greeted by the goddess Ceres with the words: "Hail, many-coloured messenger." Ceres was the Goddess of Plenty. There are many "many-coloured messengers" in the Society of Dyers and Colourists. May the Goddess of Plenty continue to hail them.

"Our Guests"

Dr. H. W. Ellis (*Chairman of the London Section*), in proposing this toast, said that this Dinner marked the start of the second half-gross of these functions. This was a typically British quantity, and one which was, perhaps, more familiar to those engaged in textile manufacture than to dye-users or dye-makers, but it did represent a most noteworthy achievement. It was often said that one can tell a man from the company he keeps, so surely it should be possible to judge the Society by those guests who accepted its invitations. It was his very pleasant duty and privilege to propose that the company should in due course drink the health of the guests who were present that evening, for the Society was honoured and flattered by their attendance.

He wished as Chairman of the London Section of the Society to say how gratified all of the members in London were that that town should have been selected as the venue for that extremely fine gathering.

Firstly, there was the most eloquent Guest of Honour, Lord Milner of Leeds. He was, as they would already have deduced from his title, a Yorkshireman. In fact, Lord Milner could in that society be described as *the* Yorkshireman, for he was President of the Society of Yorkshiremen in London. Dr. Ellis confessed to being puzzled as to why Yorkshiremen should feel the need to band together, presumably for protection, in that town, and assured them that Londoners were not as tough as all that.

Dr. Ellis said how glad, proud, and delighted the Society was to welcome the Chester Herald of Arms, Mr. James Frere. Everyone was aware of the honour which had accrued to the Society through the granting of a Patent of Arms*, and the Society's members were very gratified to have the opportunity of expressing to the Chester Herald their gratitude and appreciation of the help which he had given to the Society in this matter.

The Society was also pleased to welcome the Prime Warden of the Worshipful Company of Dyers of London, Mr. H. B. Sissmore, and Mr. D. Balfour Park, Clerk to the Company. There had been for many years the most cordial relations with the Company, and we were all very conscious of the fact that the Research Medal which was offered each year was of very great benefit to our craft.

We were also delighted to welcome Mr. R. C. Oakley, who was until recently High Sheriff of Bedfordshire. Mr. Oakley was a very good friend indeed to the Society, and he knew that members would join him in congratulating Mr. Oakley on his election as a Vice-president of the Society.

Last of the guests whom he wished to mention individually was Mr. C. G. Hulse, of the Board of Trade. Mr. Hulse was well known to many, and was welcomed very sincerely.

As he did not wish to make a long speech, Dr. Ellis said he proposed to group the other guests, and mentioned first of all, four Past Presidents—Dr. C. J. T. Cronshaw, Dr. C. M. Whittaker, Mr. H. H. Bowen, and Mr. Fred Smith. He assured these gentlemen that they would always be held in the highest esteem by members of the Society. A welcome was also extended to Sir Robert Robinson and to Mr. John Barritt, who had received the highest honour, that of Honorary Membership, which the Society could confer. These awards were richly deserved, Sir Robert's in connection with the Perkin Centenary and Mr. Barritt's for his work as one of the finest Honorary Secretaries the Society had had.

Dr. Ellis went on to stress that the Society maintained very cordial relationships with other learned societies, and we were glad to see representatives of the Royal Society, the Chemical Society, the Royal Institute of Chemistry, and the Royal Society of Arts. There were also present representatives of the Textile Institute, the Association of British Chemical Manufacturers, the British Colour Council, the Oil and Colour Chemists Association, and the Textile Finishing Trades Association. He wished to give a particular welcome to Sir Ernest Goodale, who represented the British Colour Council: Sir Ernest had been of great help to the London Section.

It was a fact that the prosperity of the Society rested to a large extent upon the directors and staffs of the dye-using and dye-making firms. We were very fortunate in having with us men who represented some of the great companies in that field—the Bradford Dyers' Association Ltd., the British Cotton and Wool Dyers' Association Ltd., Courtaulds Ltd., Tootal Broadhurst Lee Co. Ltd., and of the dyemaking firms representatives of Brotherton & Co. Ltd., the Clayton Dyestuffs Co. Ltd., the Geigy Co. Ltd., L. B. Holliday & Co. Ltd., Imperial Chemical Industries Ltd., Sandoz Products Ltd., and the Yorkshire Dyeware & Chemical Co. Ltd. Everyone was grateful to these gentlemen for the support which they and

* See Frontispiece to this issue.

their firms had given to the Society in the past, and he hoped that they would all in future encourage their staffs to play an active part in the affairs of the Society.

There were also present Mr. L. E. Jones, the Honorary Patent Agent, Mr. W. R. Mathers, the Perkin Trustee, and Mr. R. D. Chorley of Messrs. Chorley & Pickersgill Ltd., the printers of the *Journal*, who did not get much publicity but whose work was nevertheless greatly appreciated.

Dr. Ellis finally mentioned what he called the "maids of all work", the Honorary Secretaries of Sections, and he thought that on at least one day of the year an appreciation of their work should be voiced.

Mr. H. B. SISSMORE (*Prime Warden of the Worshipful Company of Dyers of London*) said that he had very nearly not been able to attend the Dinner, as it was only on very rare occasions that a Prime Warden left the City of London, and Prime Wardens did not usually wish to go farther West than about 200 yards beyond St. Paul's. His Court had given very careful and anxious consideration as to whether their Prime Warden could be allowed to go so far West as Grosvenor House. A request was made to the Clerk to work out a route, which he did as quickly as possible, taking about two days.

The Prime Warden said that he had hesitated to come amongst such learned assembly, but he had known he would meet many friends, and if he were to expatiate on the good works of the Society he would go on for a very long time; he therefore proposed to mention only three members. They were a Past President and the President-elect, who were members of the Dyers Company, and he was very glad that Dr. C. J. T. Cronshaw had distinguished himself by being Prime Warden and President of the Society. Dr. C. M. Whittaker had, however, been so hardly worked by the Society that he had not gone on to serve on the Court of the Company, and Mr. Sissmore hoped that in future the Society would not work its members so hard that they could not join the Company.

One other reason why he was present was that it was mentioned six or seven years ago that the Society had got its Presidential badge in the City, and now it had collected its Coat of Arms in the City, so that the City was of some use to the Society. Long may the Society of Dyers and Colourists be intermingled with the Worshipful Company of Dyers! When that night was long past, the guests would remember the cheerfulness, the hospitality, and the kindness extended to them. Long may the Society of Dyers and Colourists flourish!

THE FOURTH GEORGE DOUGLAS LECTURE

Dyeing

The Apotheosis of Synthesis or a Team playing for its Colours against White

GEORGE S. J. WHITE

Meeting held at the Midland Hotel, Manchester, on 7th February 1957, Mr. Clifford Paine (President of the Society) in the chair

A subjective assessment of recent advances in dyeing technique covering machinery, research into the mechanism of the dyeing process, and new types of dyes for application to textiles.

When I was approached by the officers of the Society to give the fourth George Douglas lecture, I was informed that the subject had to be textile dyeing. While very conscious of the honour, I protested at the time that I did not get my living directly by exercising skills in the practice of dyeing, but was acquainted with it only at second-hand. My sponsors, however, persuaded me, despite this show of reluctance, to accept the interesting and challenging task. Later, when I had had a period to consider what had been said before, through a long line of the *Journals* of the Society, in pages of the *Dyer*, in *Melliand Textilberichte*, and in the *American Dyestuff Reporter*; in books by chemists, physicists, and technologists, some concerned with a wide conspectus of dyeing, others with detailed knowledge of some section of this industry, most of which are familiar to my audience, I was a little shaken in my resolution. Next I turned to the records of a well remembered occasion in 1956, when many of us sat at the feet of Professor John Read, of our President, of Mr. J. G. Evans, and of Sir Alexander Todd, to hear a wonderful tetralogy in honour of Perkin [1]. Little that was noteworthy in the last hundred years on the development of dyeing as a result of synthetic dye manufacture was left unsaid.

Not three years ago, that excellent and informative journal, the *Dyer*, celebrated its 75th year by calling forth notable contributions on dyeing from Messrs. Percy Andrew, F. L. Barrett, C. L. Bird, A. W. Carpenter, R. K. Fourness, G. S. Hibbert, A. F. Kertess, K. A. Stott, A. E. Stubbs, H. A. Turner, C. S. Whewell, and C. C. Wilcock [2].

A little further away in time, perhaps, but still bright in our minds, is the Conference held by the Society entitled *The Tinctorial Arts Today*, almost entirely devoted to the study of both broad and detailed aspects of dyeing. Contributions were made by J. G. Evans, Mellor and Olpin, Palmer,

Gaunt, Robinson and Jagger, Edwards, Boulton, Smith, Howarth and Kilby, Thornber, Birchall, and C. M. Whittaker[3]. The prospect of being able to say something of interest on dyeing, which had not already been dealt with more authoritatively by this galaxy of specialists and those I have mentioned before, was already looking remote.

But worse could be said to follow, for the previous three George Douglas lectures, to which I devoted my attention, included the last by Dr. T. Holbro in 1953, which dealt with the search for new dyes in relation to modern developments in the textile field[4]. Here was set forth, in a critical and learned manner, a survey of dyes and dyeing from the point of view of a very distinguished chemist.

The second George Douglas lecture, by my friend, Dr. Rowland Hill, fortunately left dyeing alone[5]. It was, however, an outstanding contribution by a man who has figured prominently, almost from the beginning of the chemistry and development of high polymers to the present day.

Lastly, my *Journal* pages turned back to that paper by the late Dr. Herbert Levinstein which initiated this series[6]. We, middle-aged ones, still young, perhaps, in our technologies, not only view with awe the breadth of the canvas he covered, illuminated as it was with much humour and personal anecdote, but above all, we will ever recall his vitality and enthusiasm, and the fighting spirit which sustained his interest in dyes and dyeing until his last days.

With all this on the record, what, then, could I add, sufficient to grace this important occasion? After many doubts, hesitations, and false starts, I decided that no objective review of all the recent advances could be made; I would, therefore, set forth and highlight the changes and advances in dyeing which I think—and this, I stress, is a purely personal view—are pointers and signposts indicating where academic truth and technical progress may be found.

I might draw a parallel between what I propose and the panorama which could be seen by a traveller who climbed a nearby hill to look out over a multiplicity of mountain ranges stretching to the horizon and illuminated over his shoulder by the setting sun. The nearer hills and mountains would be bright, but their detailed shapes would not be separable. In the middle distance the taller peaks would stand out against the shadow of the lower hills. Lastly, the distance would yield only an isolated high mountain, somewhat dimmed, perhaps, by the mists of the evening. Another person from a similar hill some distance away would see essentially the same view but with variations and omissions, nevertheless with such a substantial measure of agreement that at least the larger part of the panorama would be common to both.

Let us therefore climb to our vantage point and look out on the prospect. What advantages have the dyers of today which their fathers did not share? It may be as well to study these under three headings: the first concerns advances in machinery; the second, advances in knowledge of the dyeing process; and the third, advances in the gamut of dyes available.

The first great difference between the dyehouse of today and that of twenty years ago is the use of better machinery. The main improvements include ease of control and ease of cleaning, but can be extended to cover the generally brighter, lighter dyehouse.

It was only at the outbreak of the Second World War that continuous dyeing was widely and successfully achieved in the United States for coloured goods other than aniline blacks and mineral khakis. Of all the processes which have been considered, there is no doubt that the pad–steam method, first publicised by E.I. du Pont de Nemours & Co. Inc., is the most versatile, being of potential application to nearly all types of cloth and to vat, sulphur, direct, and reactive dyes. Perhaps not so versatile, but having special advantages for the British and European processer, is the Standfast molten-metal machine, an advance which has been the subject of lectures and communications to the *Journal*[7] and whose main inventor, Mr. W. Kilby, has been awarded the Gold Medal of the Society.

Another new machinery development in modern dyehouses has been brought about by the special needs of the so called hydrophobic fibres. Terylene, particularly, has stimulated latent interest in dyeing in water at temperatures above 100°c. Several engineering approaches to the problem have been successful to some degree; piece dyeing on jigs capable of running in a kier, and autoclaves for package dyeing of yarn and loose material, can be found in many up-to-date dyehouses.

One other feature would be noticed especially by George Douglas were he to return and take a look at a modern dyehouse. This would be the enclosure of winches and jigs. This practice, first used extensively in Scandinavia during the war to conserve fuel, I believe, was rapidly adopted in Britain between 1945 and 1950 despite one or two unexpected drawbacks, which had to be overcome before the enclosed machines were as easy to control as the older types.

Perhaps because vast quantities of dye solvent pour down from the Pennines into Lancashire and Yorkshire, dyeing processes avoiding the use of water are uncommon. Two, however, are worth mentioning, as they are applicable to the new class of hydrophobic fibres and are similar in their underlying approach to the dyeing problem. They both involve the preparation of the cloth for the final dyeing treatment by padding through an aqueous dispersion of a disperse dye and then drying. In the Thermosol process, particularly applicable to Terylene, the treated cloth is then run through, or over, a heated surface, at or near 200°c., the time of contact being of the order of 1–3 sec. The second process takes advantage of the action of chlorinated solvents, and in the Vapocol method the padded cloth is passed continuously through the vapour of boiling trichloroethylene at about 80°c., the time of contact varying from 2 to 20 sec. depending on the individual dye[8].

Both of these processes are most dramatic, not only in the development of the colour but also in the degree of penetration through fabric and fibre which results in such a short dyeing time. So far as I am aware, neither process has yet been developed commercially, but both are exciting the interest of practical dyers and constitute a challenge to traditional methods.

These, then, seem to me to be the brighter lighted peaks of achievement in modern dyeing machinery.

Now let us turn to our second topic, which is a better understanding of the dyeing process. Here it is certain that in the last quarter of a century what was an art has been transformed into a technology and in this new guise has contributed to the fundamental sciences, as, for example, in the physics of coloured objects and in the physical chemistry of the dyeing process. If we consider the latter, it is clear that the great Continental schools of colloid chemistry and electrochemistry, together with their American and British counterparts, formed the bases on which the edifice of our understanding of the physical chemistry of dyeing has been erected.

Two British pioneers, working in the early 1930s upon the scientific background of the dyeing process, may very well be held responsible for the present flourishing condition of our understanding. They would certainly acknowledge their good fortune in the encouragement which they received at the hands of their academic colleagues, of industry, and of members of this Society. The two pioneers to whom I refer are Professor J. B. Speakman at Leeds University—and we immediately recall the contributions made jointly with the late Professor F. M. Rowe—and Dr. S. M. Neale at Manchester College of Technology, who must have been greatly advantaged by his association with Mr. F. Scholefield, then Head of the Department of Textile Chemistry.

The fundamental work on protein dyeing, particularly on the wool fibre, undertaken by Professor Speakman and his colleagues was of great merit not only in itself, but also because it stimulated those contributions recorded in our *Journal* by such workers as the late F. L. Goodall, J. F. Gaunt, and the late F. Townend. The work of his school and that of Professor Rowe also greatly influenced the academic thinking of men like Vickerstaff, R. H. Peters, Meggy, and Skinner.

The parallel physicochemical investigations on cellulose initiated by S. M. Neale brought forward a confluence of men who have made outstanding contributions. Prominent among these must be my friends, John Boulton and Tom Morton, whose pearls of learning might be due also to the irritation provided by the pinch of salt and commonsense of Dr. C. M. Whittaker. Together with the practical evaluation of their hypotheses given by the work of Wilcock during the prewar decade, Neale, Boulton, and Morton laid the foundation of many ideas which are accepted today, particularly in the dyeing of viscose rayon with direct dyes. They exposed the individuality of direct dyes and demonstrated the wide differences in the dyeing properties of these individuals. They also pointed out how much more important these differences were in the dyeing of viscose rayon than they appeared to be in the case of cotton, and in this way threw light on many practical dyeing difficulties as well as upon the different organisation of the cellulose molecules within these fibres. But perhaps at least as important as their positive contribution to the fundamentals of dyeing was the stimulus they gave to the establishment of other groups or schools of investigators. There is no doubt in my mind that their work and some hard clear words by Dr. Whittaker contributed to the establishment of the Dyeing Research Section at Blackley, in the early days of which I had the honour to lead Dr. T. Vickerstaff and Dr. C. H. Giles (now at the Royal College of Science and Technology, Glasgow) as the initial team. A few years later Dr. Vickerstaff became the head of a larger group, and all of us are aware of the diverse fields in which he and his men have worked. The seed also fell in fertile ground at the Shirley Institute, where Standing, Urquhart, and their collaborators followed with a great deal of new experimental work on cellulose, extending into highly mathematical treatments of a model dyeing system. Last in this chain we must record the vigorous use of mathematical techniques by Crank, who is away ahead of most of us but whose thinking will continue to be a challenge to the imagination of our young scientists.

In considering the wonderful growth which has developed from the pioneering activities of the Manchester and Leeds schools, we must not ignore contributions from overseas. Elegant chemistry by Steinhardt and his collaborators added to our knowledge of the combination of acids and acid dyes with wool, whilst Royer and his colleagues evolved a most informative technique using fibre microscopy to follow the course of dyeing. Professor N. Gralén, a notable overseas friend of the Society, has assembled some outstanding young scientists, one of whom, Dr. B. Olofsson, seems to be carrying on a single-handed search for truth in the fiery mouth of the Donnan *versus* Gilbert–Rideal controversy.

In this brief review, I have endeavoured to indicate some peaks in the great range of contributions to a better understanding of the dyeing process. I would now like to turn to a very few detailed contributions which I have always believed contained more in them than was apparent on the surface.

My first, and an obvious choice, is taken from a paper by S. M. Neale [9] which uses the earlier work by Boulton and Reading [10]. Most of you will recall the very extensive table [9] setting forth the behaviour of individual direct dyes in the dyeing of viscose rayon and the establishment of a technique for measuring time of half dyeing as a means of comparing the rate of dyeing of one product with another. To bring home the points that these investigators made I have curtailed the

TABLE I*

Dye	*Colour Index* No.	Apparent Diffusion Coefficient in Viscose Rayon ($cm.^2/min.$)	Reciprocal Half-dyeing Time ($min.^{-1}$)	Equilibrium Absorption (%) Viscose Rayon	Equilibrium Absorption (%) Cotton	Level-dyeing Test A	Level-dyeing Test B
Icyl Orange R8	C.I. Direct Orange 12	180×10^{-6}	200	0·161	0·123	4–5	Even
Benzopurpurine 4B	C.I. Direct Red 2	$4·6 \times 10^{-6}$	2·2	3·31	1·22	—	Moderate
Fast Orange AG	C.I. Direct Orange 34	$0·71 \times 10^{-6}$	0·14	0·6	0·36	1–2	—

table both in length and in breadth while retaining the parts which I think illustrate principles which are common to all, and the hypotheses which can be based on the work (Table I). Firstly, the equilibrium absorption of dye on viscose rayon has higher values, in general of the order of twice those possible for cotton. This observation has been the subject of continuous study and must be related to differences in the macromolecular cellulose structure within the fibres. The table reveals also a clear parallel between the rate of diffusion of dyes through Cellophane viscose as measured by Neale and the reciprocal of the time of half dyeing recorded by Boulton. Lastly, there is a parallel between the technical assessment of the levelness of dyeing, that is to say, an ease-of-application function, and the time of half dyeing. Those dyes which have high figures for this parameter are those which are most difficult to apply satisfactorily.

Another idea underlying this work was the assumption that in using dye mixtures it was better to choose those individuals which were close together in the table. Doubt on the entire validity of this was thrown by some other experimental work by Neale [11], who showed that certain direct dyes, when admixed, no longer had the same half-dyeing times as they had when used alone. Lemin, Vickers, and Vickerstaff [12] also showed that what might well be true for mixtures of dyes on viscose rayon was significantly less true for the same dyes on cotton. Nevertheless, the Boulton table has been generally acknowledged as a most useful guide by practical dyers of viscose rayon.

TABLE II

The Cause of Skitteriness

	Percentage of Fibres	Average Diameter (μ)
Heavily dyed ...	39·6	2·50
Intermediate ...	43·7	2·12
Lightly dyed ...	16·7	1·87

INCREASE IN DIAMETER IN WATER COMPARED WITH VALUE IN AIR AT 65% R.H.

Heavily dyed ...	17·4%
Lightly dyed ...	11·9%

My second example is a small contribution among the many by Professor Speakman, which contains an epitome of the current knowledge of wool dyeing. The phenomenon of *skitteriness* is known to all wool dyers and particularly to wool-piece dyers. The cause was not clear until Royer and his collaborators [13], as a result of microscopic work, subsequently and independently confirmed in another place, showed that it was essentially due to the presence of dark and lightly dyed fibres in the same yarn or piece. The contribution by Barr Rowe, and Speakman [14] went further and demonstrated that, in the case of the particular sample of dyed wool they were examining, the heavily dyed fibres were of larger diameter than the lightly dyed (Table II). There were also some differences between different parts of the fibre, but perhaps more important, the heavily dyed, larger-diameter fibres swelled more in water. It is not too much to conclude from this that, although some dyes dye wool in a skittery manner, and many do not, all dyes behave initially in this way, and the subsequent levelling takes place because those fibres which are less deeply coloured in the early stages of dyeing are also those which have the greater thermodynamic affinity for the dye. A corollary to this is that a dyeing which shows initial fibre-to-fibre unlevelness may, on continued dyeing, become level in colour to the eye while at the same time the apparent colour of the yarn or fabric will become stronger, although the total quantity of dye on all the fibres is unchanged. If dyeing is continued even further a reverse situation should theoretically become apparent, but all our attempts to demonstrate this effectively in the laboratory have been unsuccessful. This explanation of skitteriness not only applies to normal wool but confirms the behaviour of acid dyes on mixtures of wool with chlorinated wool, with carbonised wool, with Ardil, and with nylon, and probably can be extended to other fibre systems.

Contribution three is by Vickerstaff and Waters, who in 1942 studied the dyeing and undyeing of the cellulose acetate fibre with anthraquinone disperse dyes [15]. They covered many facets of this interesting process, but I think the most important is that they were the first to demonstrate clearly that the dyeing process is a reversible one, which they did by redissolving the dye from the dyed fabric in the presence of an agent capable of forming micelles in water. Secondly, they confirmed that very small differences in chemical composition made startling changes in dyeing properties; and lastly, that when dyes of differing chemical composition are mixed in this type of dyeing process, some of the dyes appear to go on to the cellulose acetate fibre separately and independently of one another, a phenomenon which has by now been widely utilised by makers and users of disperse dyes. Vickerstaff and Waters examined critically the reports and work of previous investigators, repeating, and failing to repeat, some of their experiments. As a result they were able to sweep away a number of misconceptions and

TABLE III

Particle Size of Dyes and their Uptake by Rayons (Urea Printing Process)[16]

Dye	*Colour Index* No.	Mol. Wt.	Particle Radius (A.)	Type of Rayon to which applicable		
				Cuprammonium No Addition	Cuprammonium Tannic Acid	Viscose (No Addition)
Carbolan Violet 2R8	C.I. Acid Violet 51	584	89·1	+	—	—
Carbolan Yellow 3G8	C.I. Acid Yellow 72	546	66·8	+	—	—
Coomassie Brilliant Blue R 250	C.I. Acid Blue 83	825	63·2	+	+	+
Coomassie Brilliant Blue FF 250	C.I. Acid Blue 15	815	22·5	—	+	+
Carbolan Crimson B8	C.I. Acid Red 138	677	20·8	—	+	+
Coomassie Violet R 150	C.I. Acid Violet 17	761	20·2	—	+	+
Disulphine Green B 150	C.I. Acid Green 9	724	16·8	—	+	+
Coomassie Milling Scarlet 5B8	C.I. Acid Red 89	728	16·4	—	+	+
Disulphine Blue A 200	C.I. Acid Blue 5	703	14·9	—	+	+
Coomassie Yellow RP	C.I. Acid Yellow 42	758	14·0	—	—	+
Lissamine Green 8F 150	C.I. Acid Green 5	792	12·8	—	—	+
Coomassie Violet 2R8	C.I. Acid Violet 9	711	12·7	—	—	—

misguided hypotheses based on insufficient evidence, and have left us with a much clearer view of the process of dyeing cellulose acetate with the disperse dye systems.

The fourth contribution which I would like to mention is one by Meitner, in which he studied the behaviour of dyes in the so called urea printing process for viscose rayon[16]. He made measurements of the particle size of a number of dyes using the Fürth cell and then classified them according to their behaviour in the printing process. Several points of interest emerge from the work. Firstly, there is no relation between molecular weight and practical behaviour (Table III). Next, fibres of such chemical similarity as viscose rayon and cuprammonium rayon must have very substantial physical differences to explain their differing dye uptake. It would seem that either viscose rayon has a smaller pore size than cuprammonium rayon or the ratio of the swelling in water at 40°C. to that at 100°C. is less for viscose rayon, so that a greater number of dyes are retained locked within the fibre. Let us also notice that a treatment with tannic acid must so close and obstruct the pores of the fibre that an extended range of dyes are retained. This is no doubt a parallel effect to that of the urea– or melamine–formaldehyde resins in giving increased wash fastness to some direct dyes.

Furthermore, it seems that dyes which are of larger particle size in aqueous solution have a greater tendency to aggregate within the fibre and so prevent their subsequent removal. If this is so, then the phenomenon in this urea printing process is cognate with that shown on the soaping of vat and azoic dyes, and on steaming of vat dyes on nylon. Rowe, Kornreich[17], and Sumner have separately made their individual contributions in this field, and it appears that the first stage in the dyeing of a leuco vat dye on to a fibre is for the dye to be adsorbed in the molecular state as in dyeing with direct dyes. After oxidation there is a short period of time during which the resultant quinone form may also remain molecularly dispersed, but the function of soaping or steaming is to facilitate the alignment of molecules within the fibre into crystals or aggregates often detached from the cellulose molecule but locked in some interstitial space and very resistant to removal by alkali and detergent.

Continuing with this train of thought, you will all recall that it is possible to apply vat dyes to nylon by working at elevated temperatures and using sodium formaldehyde-sulphoxylate in place of sodium hydrosulphite. Nearly all vat dyes when applied to nylon show marked differences in light fastness from the same vat dyes on viscose rayon or cotton as substrate. Some, like Caledon Red BN, are quite incredibly different, in that they may be assessed as 1 or 2 on the international fastness scale, as against 8 for cotton. If these dyeings are given a period of steaming or prolonged soaping at the boil, aggregation within the nylon fibre is facilitated and the light fastness is greatly increased, approaching the normal. Unfortunately, this behaviour is accompanied by poor dry rubbing fastness, and it seems clear that the necessary aggregation of the vat dye within the fibre to give the normal light fastness on nylon can be accomplished only in an unusual way, viz. by growth of the crystal structure outwards through the surface of the nylon fibre. This behaviour is very like that shown by certain very slightly soluble pigments when moulded at high temperatures into polymers containing plasticisers and subsequently cooled, and the surface of such a plastic shows crystals of dye growing outwards in a hairy form.

The last contribution which I would like to highlight is one by R. H. Peters, now Professor of Textile Chemistry at the Manchester College of Science and Technology. It appeared under the title *Nylon Dyeing—A Study of the Mechanism of the Dyeing Process with Acid Dyes*[18].

This was a neat and classical contribution, which can be seen to have stemmed directly from the Speakman school of thought in its theoretical interpretation of the experimental evidence. Peters measured the combining property of the nylon fibre for acid at various pH values and showed that there were two stages of combination—one simple and reversible, which he attributed to the formation of positively charged ions on the

amine end-groups of the nylon molecules; and the second, only partly reversible, a combination with the charged nitrogen in the amide groups. Peters also showed in the normal dyeing process for nylon that, in the presence of a weak acid, dye anions combined with the charged amine ends in accordance with their basicity. In other words, it was possible to apply a greater quantity of monobasic dye to nylon, in the proportion of approximately three to one by comparison with a tribasic dye. He showed also that the number of charged amine ends was only about one-twentieth of those present in wool and one-quarter of those in silk. For these reasons, all sorts of odd and anomalous practical dyeing behaviour which occurred when mixtures of anionic dyes of differing basicities were applied to nylon could be readily explained. Subsequently he showed that these generalisations were not the whole story, and with Atherton demonstrated the saturation phenomena for a number of different dyes over a wide range of dyebath concentrations [19]. Most of the results confirm Peters' first hypothesis, but one dye at least showed a higher affinity than was possible from its basicity, and this was thought to be due to aggregation within the fibre, or to non-ionic adsorption, rather as in cellulose acetate dyeing.

Having now looked at these five examples of dyeing research, we can enunciate some common factors—

(*a*) *Dyes are Ambivalent*

Part of the molecule is attracted to water, part is repelled by water. Dyeing on to a fibre is favoured if the energy of repulsion by the water molecules, plus the energy of adlineation of the dye on to the molecular surface of the fibre, exceeds the energy of attraction by the water molecules for the hydrophilic portion of the dye.

(*b*) *Dyes are Individuals*

They can be applied in mixtures only by exercising knowledge and skill, as some dyes in the same chemical series mix in solution and go on to the fibre without affecting one another, and others do not.

(*c*) *Dyes are of about the Right Size*

The size of the hydrophobic portions of dye molecules is not greatly different from that of the "pores", "interstices", or "amorphous space" in textile fibres. Dyeing within the fibre is by movement from one active site to another active site, the statistical freedom of sites from dye molecules providing the energy gradient for diffusion. As in the U.S.A., migration takes place toward the empty spaces.

(*d*) *Dyes aggregate*

Dyes in aqueous solution tend to aggregate. Higher temperature favours simple molecules. Dyes within fibres often aggregate to give desirable fastness properties, but the process can be carried too far, so that gross crystallisation occurs, resulting in loss of fastness to rubbing or "blinding" of the fibre.

(*e*) *Dyes are resistant to Removal*

Dyes resist removal—

(i) If within the fibre aggregation, polymerisation, or chemical reaction is possible (e.g. vat, chrome, azoic dyes)

(ii) If the pore size or swelling of the fibre is reduced (e.g. by crease-resist finishing)

(iii) If the water-solubilising part of the molecule can be removed (e.g. solubilised vat dyes, Alcian Blue)

(iv) If the dye can react with the fibre.

This last category in my summary of the theoretical contributions to an understanding of the dyeing process leans heavily on the chemical composition of the dye and leads directly to my final section. This must be but a brief addendum to the story displayed by Dr. Holbro in the third George Douglas lecture [4].

A survey of recent dye chemistry exhibits clearly an enormous contribution by Swiss industrial chemists in the field of azo and metallised dyes. The ranges initiated by the Neolans (Ciba) and extended in recent years by neutral-dyeing members with new and varied trade-names must rank as of great practical significance wherever wool and related protein fibres are coloured. In essentially the same chemical field, the copper-containing direct dyes and those which can be aftertreated with various copper compounds are equally outstanding, and in this field, too, the Continental dye chemists are highly skilled.

Phthalocyanine chemistry was discovered in Britain and pioneered here, particularly for the production of new pigments. The presence of this range of blue to green colouring materials of extremely high resistance to light and chemical attack must have been largely responsible for the success of two new processes of textile coloration greatly developed since the war. These are the incorporation of pigments into viscose rayon manufacture to produce coloured fibres, and the application of paint or printing inks of a novel type to textiles in piece form to give all-over colouring or printed designs. British and European dyemakers led, and still lead, the world in the coloured viscose yarn field, but the initiative in pigment printing compositions came from the U.S.A. European makers have accepted the challenge and can now provide easy-processing compositions giving printed and coloured textiles of very good fastness.

Phthalocyanine chemistry developed dyes for textiles, and here the laurels might rest evenly between the German chemist who devised a textile-dyeing process for making copper phthalocyanine inside cotton and viscose rayon fibres and my colleague, Norman Haddock, who rendered phthalocyanine temporarily soluble in water by quaternisation, so that a beautiful turquoise blue could be printed in a fast colour style.

Lastly come the reactive dyes, which have bubbled up during the Perkin centenary year. Apart from the intrinsic promise of these new dyes, they come as a spur and a stimulus to all the world-

wide teams of organic chemists devoted to invention and speculation in the fields of the tinctorial and allied arts. They demonstrate what treasure may still be turned up among the old workings.

Insufficient time has elapsed for a full assessment of the practical possibilities of reactive dyes. Sufficient, perhaps, to say that for the ultimate consumer they provide a broadening and a brightening of the colours available in dyed and printed cloths which are fast to washing, dry cleaning, and rubbing.

To yarn and piece dyers, they provide dyes of excellent level-dyeing properties, generally easy of application, and, for certain special cases, dyeing at low temperature, with potential fuel savings. To those processers who have continuous-dyeing equipment they are specially interesting.

Individual members show individuality not only in such properties as fastness to light and chlorine, but also in dyeing behaviour, thus repeating the pattern we know so well in other, older ranges of dyes.

All dye chemists must be anxious to have more details concerning the reaction which results in a covalent chemical link with a cellulose or a protein molecule, in place of the more usual ionic, van der Waals, or embedding techniques for getting dyes on fibres fast to washing. I regret that insufficient experimental work is yet available to show conclusively how the covalent bond is created, although by implication it is presumed to be by reaction of the labile chlorine atoms in the dye molecule with one or more hydroxyl groups in viscose rayon or cotton, or perhaps amine groups in wool or silk, with the elimination and neutralisation of hydrochloric acid. Let us hope that the industrial development of reactive dyes and the theoretical background chemistry will so extend and multiply that they themselves may form the subject of a not too distant George Douglas lecture.

This now completes the range and the extent of the task I set out to cover at the beginning of this lecture, but before leaving my subject, may I, as angels have done before, lift the hem of the parti-coloured cloak which hides the future of dyeing?

You will all have wondered at the flask and exhibits set out before you. They represent two natural phenomena, miracles of chemical synthesis under chemically simple conditions, which probably offer no promise to the textile dyer of the future. In the beaker we have a sheet of pure cellulose made by *Acetobacter xylinum*. In the other, indigo made in a similar manner by the fungus *Schizophyllum commune* (mutant blue 131), provided by Miles, Lund, and Roper of the University of Buffalo. Although the history of penicillin manufacture shows a forty- or fifty-fold increase of efficiency since its industrial manufacture began, even were there to be such a rapid advance for this indigo-making fungus, traditional chemistry should still lead.

The future of our conventional dye ranges may be looked at in three lights— blue, green, and red if you are a physicist; or blue, yellow, and red if you are a dyer. The blue group, so appropriate to the conservative dyers of the future, may include chrome dyes, certain acid wool dyes, metallised and metallisable direct dyes, and disperse dyes. The bright component in light is green, giving the "go ahead" to the best of the vat dyes, to the new reactive dyes, to the painting of fabrics with pigments and polymers, and to the incorporation of pigments during fibre manufacture. The red light stands out against alizarin, soluble vat dyes, appropriately against azoic dyes, and perhaps against indigo.

* * *

My indiscretions and lecture are now at an end. May I thank the George Douglas Lecture Committee for giving me this interesting task, and my colleagues at Blackley for much help.

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COMMUNICATIONS

The Dyemaking Works of Perkin & Sons
Some Hitherto Unrecorded Details

W. H. CLIFFE

Although the works of Perkin & Sons at Greenford Green are now part of industrial history, little is known of them today. Some details which have recently come to light are not without interest and are now recorded for the first time.

During the twenty prosperous years which followed 1857, Greenford Green knew the manufacture of artificial colouring matters. What began as a seemingly rash adventure with the production of Mauve developed by 1873 into a flourishing industry stretched to the limit of its capacity yet far from satisfying the demands of the dye users.

There were many who wished to build on the solid foundations laid by Perkin & Sons. When William Henry Perkin and his brother Thomas Dix Perkin decided to retire from business, the future of the Greenford Green works seemed assured as they were purchased by Brooke, Simpson & Spiller. No more worthy successors could be imagined, for the purchasers had already succeeded in 1868 to another flourishing business, the Atlas Works of Simpson, Maule & Nicholson at Hackney Wick.

Yet less than two years later, in 1876 or even before—for the precise date is difficult to determine*—Brooke, Simpson & Spiller quite unaccountably parted with the Greenford Green works and their alizarin rights to Burt, Boulton & Haywood. Not long afterwards the new owners concentrated manufacture at their main works at Silvertown, and the great days of Greenford Green were at an end.

Apart from the few bricks which still stand, there is today scarcely any tangible evidence that the works of Perkin & Sons ever existed. The books and working papers have long since disappeared. Of the pamphlets and price-lists, business letters and invoices which must have been numbered by the thousand, there is no known single survivor. How the business was conducted, what stocks were held, at what prices raw materials were purchased and manufactured goods sold have been matters only for speculation.

Within recent months, however, it has become possible to answer at least some of the questions. Fortunately, some of Sir William Perkin's private papers have been retained by his family, through whose kindness the writer has been privileged to study their contents and to make known some of the more interesting details which have been disclosed. Most of what is now set out is based on statements left by Thomas Dix Perkin and may represent all that will ever be known of the Greenford Green works apart from what is so far common knowledge. It is believed that committal to paper may be defensible, if only on the grounds that Perkin & Sons were the first manufacturers of synthetic dyes in the world.

* Since the above was written Mr. L. E. Morris, Editor of *The Dyer*, has consulted the Records Department of the London County Council and has established the date as 4th September 1876.

It is not certain when Magenta was first manufactured by Perkin & Sons. It was the second aniline colouring matter to be discovered, and whilst the credit rightfully belongs to Verguin, it was Renard Frères, silk dyers of Lyons, who first produced it commercially in 1859. It was probably made by Perkin & Sons not long afterwards, because Thomas Dix Perkin patented an alternative process based on the use of mercuric nitrate[1]. The new process was both dangerous and capricious, and was soon discontinued. Whilst Magenta was never again made at Greenford Green, it was the basis of Britannia Violet and Perkin's Green, two dyes which were made in quantity up to the time when the factory passed into the control of Brooke, Simpson & Spiller. It is known that manufacture was hampered by the necessity of buying Magenta, but from whom was it purchased? The most likely source was Simpson, Maule & Nicholson, who held the premier position in the country as Magenta manufacturers and who undoubtedly were in business relationship with Perkin & Sons. If it were here that Perkin & Sons obtained their Magenta, it has to be explained why supplies suddenly ceased when Simpson, Maule & Nicholson were acquired by Brooke, Simpson & Spiller. In a later paper (p. 319) the writer will seek to show that Perkin & Sons were not customers of Brooke, Simpson & Spiller. It is necessary, therefore, to look elsewhere for a concern whose Magenta found its way to Greenford Green.

It has recently been discovered that, about the year 1864, Perkin & Sons were contemplating a major reorganisation of the business. A plan was afoot to convert the firm into a limited-liability company. Although it came to nothing, the articles of association were set up in print, and W. H. Perkin's copy survives today. The document is undated, but it is inferred from its contents that it was printed in 1864, significantly the year during which Perkin discovered Britannia Violet. As they may be useful as the basis of research by others, it is worth quoting a few of the more informative clauses—

> 43. The number of the Directors shall be twelve, and the first Directors shall be the Subscribers of the Memorandum of Association.
>
> 44. Until otherwise appointed, Thomas Dix Perkin shall be the Manager of the Greenford Green and the Brentford Works.
>
> 45. The future remuneration of the Directors, and their remuneration for services performed previously to the first General Meeting, shall be determined at a General Meeting; provided always that the salary of the said Thomas Dix Perkin shall be determined in the agreement of the 11th October, 1864, hereinafter

mentioned or as the Directors shall hereafter determine.

49. The Directors shall take from Messrs Renard Brothers and Franc, or any other person or persons authorised in that behalf, an assignment or lease to the Company of the said manufacturing Company at Brentford called the Ham, as from the 1st of July, 1863, or any other date, and subject to all the clauses and agreements as may be agreed upon between them respectively.

50. The Directors shall take from Messrs Perkin & Sons, late chemical manufacturers, of Greenford Green in the County of Middlesex, or any other person or persons authorised in that behalf, an assignment of the works and dependencies situate at Greenford Green aforesaid, now or lately the property of the said Messrs Perkin & Sons, the land on which the works are erected, their or lately their buildings, machines and plant in general, their or lately their stock, both in raw materials and manufactured goods, their or lately their patents, both those which they have taken out themselves and those which they have purchased, their or lately their processes and inventions relating to coal-tar products of colouring matters generally, their or lately their business, and in general all that appertained to their trade or manufacture, and in return and as the price of this acquisition of Messrs Perkin & Sons' entire business the Directors shall take the said works, buildings, land, plant and patents at two-thirds of the cost price established by Messrs Perkin & Sons' accounts up to the 30th of June, 1864, and at a cost price for any acquisitions after that date, so as the total sum to be paid to Messrs Perkin & Sons, or the said other person or persons authorised in that behalf in respect of the foregoing do not exceed the sum of £15,000; and the Directors shall purchase the stock now or lately belonging to Messrs Perkin & Sons at the following prices, that is to say the raw materials at invoice price, and the manufactured goods at cost price.

51. The Directors shall from the 1st November 1864 pay all the expenses and receive all the profits of and from carrying on the said respective businesses formerly carried on at Greenford Green aforesaid by Messrs Perkin & Sons, and at the Ham, Brentford aforesaid.

52. The Directors shall adopt a certain agreement headed outlines of agreement purporting to be made and signed in duplicate at Lyons the 11th day of October, 1864, between the said Messrs Perkin & Sons therein described as chemical manufacturers, of Greenford Green, Middlesex, of the one part, and La Fuchsine Limited Liability Company, capital 4,000,000 francs, of Lyons, France, of the other part. The Company shall be bound by all the clauses, conditions, charges, and agreements contained in the said agreement of the 11th Day of October, 1864, on the part of the said La Fuchsine Limited Liability Company to be done and performed, and the Company shall be entitled to all the benefits and advantages in the said agreement contained in favour of the said La Fuchsine Company in the same manner and to all intents and purposes as if the Company were a party to the said agreement in the stead of the said La Fuchsine Company; and for the more effectually accomplishing the objects of this clause the Directors shall have power to make any other contracts with the said Messrs Perkin & Sons or any either of them.

The few clauses of the articles of association which have been quoted suggest further research. There appears to have been some relationship between Renard Frères of Lyons and La Fuchsine Company of the same city. The latter may have been a subsidiary or an offshoot of the former, brought into being for the purpose of making or marketing Magenta. Then there is the third name with some connection with the other two, that of Renard Brothers & Franc, of the Ham, Brentford. The Brentford concern, from Clause 49 above, seem to have been more than agents: probably they were manufacturers in this country of Magenta by the Verguin process. It is possible, therefore, that this was the source of Perkin & Sons' Magenta. There is little likelihood, so far as can be seen, of discovering why the amalgamation of Perkin & Sons and Renard Brothers & Franc came to nothing. It does seem possible, however, that when Greville Williams left Greenford Green in 1868 his new venture of Williams, Thomas & Dower acquired the premises, plant, and perhaps processes of Renard Brothers.

Perkin & Sons' works were built on rather more than six acres of freehold land. Although in a rural setting, they were conveniently placed on the banks of the Grand Junction Canal, but the great drawback was the entire absence of means of drainage, so that probably effluent pits had to be used. The firm owned an additional plot of about two acres on the East side of the road, and here were to be found some cottages, a store, and a laboratory. Many years later, when Sir William Perkin was en voyage to America to take part in the Jubilee Celebrations of 1907, he wrote a hurried account on the writing paper of the Cunard liner *Umbria* describing some of the laboratories in which he had worked. Although only a part refers to his works laboratory, the whole ought to be made known, and is here reproduced in full, with the exception of a few words which cannot be deciphered—

> The first public laboratory I worked in was the R.C.C. [Royal College of Chemistry], in Oxford Street, London in 1853–1856. This was very different to our present one, the appliances being few. We had to make our H_2S in a small square chamber connected with the chimney flue. There were no stink closets except the covered part of a large sand bath heated with coke. There were no Bunsen burners but we had short lengths of iron tube covered with wire gauze. For combustions we used charcoal. A bench and cupboard containing reagents and use of the above chamber was all we practically had and a charcoal combustion furnace in addition for advanced students. There was also a balance room downstairs.
>
> My own first private laboratory was half of a small but long-shaped room with a few shelves for bottles and a table. In the fireplace a furnace was also built. No water laid on or gas. I used to work with old Berzelius spirit lamps and in a shed I did combustions with charcoal. It was in this laboratory I worked in the evenings and vacation times and here I discovered and worked out my experiments on the mauve. The little back garden was afterwards used to conduct larger operations but . . . and in which I found it possible to prepare nitrobenzene and aniline in iron vessels previously glass or earthenware had been used only. Previously or about the same period I also worked for a few weeks in a laboratory of my friend Mr. Duppa fitted up in the back apartment of his house at Hollinbourne House in Kent. Here the appliances were very small indeed but we discovered bromoacetic acid there from which we obtained the artificial formation of glycocol a very important discovery and glycollic acid.
>
> My second private laboratory used while the mauve dye works were building was a small back wash-house of the house we rented and again except for a few shelves and a table and the sink there was nothing else. Here work on malic acid and fumaric acid and tartaric acid and chloromalic acid was done and some of the work which led up to the artificial formation of tartaric acid. Work in this was very difficult and painful because the researches required the use of considerable quantities of PCl_5 and the room was small and low and the vapour of HCl and worse, that of PCl_3O was very trying indeed there being no means

of ventilation but the window which let in the draught so that it could not be used.

The next was again a small wash-house in the gatekeeper's cottage at the mauve works similar to the first. But after this I had a proper laboratory built in the works with balance room also stink closet and most of the appliances of the day which were very few but no gas. Here I obtained tartaric acid artificially and conducted my researches on mauveine and discovered other colouring matters.

The number of Perkin & Sons' employees is unknown, but four of them can be identified. It is well known that Greville Williams worked at Greenford from 1863 until he left to assist in founding the firm of Williams, Thomas & Dower in 1868. He was already an experienced research worker by the time he joined Perkin & Sons, and might naturally be supposed to have used his talent for investigation to the benefit of his new employers. The question is resolved by a letter addressed by Williams in his later years to Professor Raphael Meldola, who was gathering information for his obituary of Sir William Perkin—

Bay Cottage,
Smallfields,
Near Horley, Surrey.
10th October 1907

My dear Meldola,

Owing to the weakness and infirmities of extreme old age, I dread receiving letters as answering them is laborious and painful to me. But in such a cause silence would be a sin.

Yes, that great chemist Perkin had a private laboratory at Greenford. My work was in the factory. The synthesis of coumarine was effected in the private laboratory at Greenford.

Trusting that you and your wife are well and happy, pray believe me always.

Very sincerely yours
Greville Williams

There were at least three other chemists, referred to by T. D. Perkin as Mr. Stocks, Mr. Brown, and Mr. Williamson (cf. Fig. 1).

Of Stocks little or nothing is now known, except that he was for more than five years in the service of Perkin & Sons. Brown can positively be identified as James Thomas Brown, who, like W. H. Perkin, received his training at the City of London School and the Royal College of Chemistry. He worked at Greenford Green for over ten years, and something is known of his subsequent career [2].

The Williamson whom T. D. Perkin mentioned briefly as assistant to W. H. Perkin is recognisable as Robert Williamson (1853–1914), who, years later, founded the firm of Williamson & Corder, gelatin makers of Newcastle-on-Tyne, which still exists. He has been described as the last surviving member of the little group of chemists who were connected with the Greenford Green works during Perkin's time [3].

In 1873, and how long before that is not known, there was in one part of the works a row of iron retorts, about twenty-five in number, set in brickwork and carefully whitewashed from time to time. They were used for distilling residues and were fired individually. On the other side of the chimney shaft were additional retorts, differing from the others in that they were set three to a furnace, an arrangement which was found to be satisfactory and with the great advantage of economy of fuel. In time, of course, retorts wore out or were damaged, and this occasionally resulted in a fire, such as that which occurred during the second week of January 1874. They were so arranged that they could be dismantled and new retorts set in place in a few hours without disturbance of brickwork. Sometime before November 1873 a number of new retorts were ordered from Bailey, Pegg & Co., of which nine were delivered in January 1874. The cost is not recorded, but T. D. Perkin said that he was accustomed to paying from £9 to £12 for each according to the price of iron.

It appears that all, or most, of the water required by the works was drawn from an artesian well and that supplies were adequate until alizarin was manufactured in steadily increasing quantities. It was then found that the single pump was incapable of delivering water in the quantities required, and, as a temporary measure, water was taken from the nearby canal. Perkin & Sons were driven to consider deep well pumps to be operated by an existing steam engine, and they obtained a quotation from De Ritter of £75 for each. Most of the extra water was required for use in what was known as "Self's room", in which a particular stage of alizarin manufacture was carried out. It is possible that Self was the name of the foreman or workman in charge of the operation. Perkin & Sons sold the works before reaching a final decision about the pumps, but they repeatedly recommended them to Brooke, Simpson & Spiller, who, it is thought, paid little attention.

Perkin & Sons used Howard's safety boilers, which they believed to be the best that had ever served works such as their own and which could be used with perfect safety at a pressure of 120 lb. per sq.in.

As might be expected, the works were equipped with evaporating pans, but nothing is known of their number, size, or location.

The Greenford Green works must have expanded at a very rapid rate, particularly during the last few years of Perkin & Sons' tenure. In the two years up to June 1873 the cost of new plant totalled £31,600. Without doubt most of it was needed to keep pace with the growing demand for synthetic alizarin. It will be remembered that at this time Perkin & Sons had no serious competition in the alizarin market. Until well into 1873 they marketed their product at 3s. 0d. per lb., but afterwards reduced the price to 2s. 3d. per lb. They could well afford expenditure on new plant, because, during the twenty-seven months ended on 30th June 1873, gross profits were running at about £60,000 per annum.

Like all prudent manufacturers, Perkin & Sons protected themselves against the unforeseen by insurance. The cost of the premiums is no longer known, but insurance, together with rates and taxes, amounted to £228 per annum.

There is abundant evidence that Thomas Dix Perkin exercised great care and foresight in the purchase of raw materials and supplies. He was not unmindful of the advantages of paying cash and was accustomed to receiving a discount of 2½% in return. The solvent naphtha used at the

works, which was held to be of very good quality, came from Blott & Co., tar distillers of Poplar, but some few casks of benzole naphtha were delivered by Davis of Willesden.

Perkin & Sons believed in maintaining adequate stocks: coal, for example, was kept in four heaps totalling 800–1,500 tons and seldom fell below the former figure.

At the end of 1873, in pursuance of the sale of their works, Perkin & Sons made an inventory of stock. Today, more than eighty years later, the figures are of no little interest and are given in full in Table I.

The figures in the list relating to anthracene are not very informative, because nothing is said of the quality of the material. Perkin & Sons' crude anthracene was drawn from many sources, and inevitably there were wide variations in quality. Its cost was reckoned at so much per cent per cwt. For example, 15% anthracene at 1s. 0d. per cent (or per unit) cost 15s. 0d. per cwt. of crude anthracene. Writing in 1879, W. H. Perkin said [4]—

> It will perhaps be of interest here to record the prices paid for anthracene during the first year or two of the manufacture of artificial alizarin. In 1870–1871 we gave from 9d. to 1/6d. per cent per cwt. and in 1872 from 1/6d. to 5/– and a small quantity at 5/6d. This shows how the price advanced with the demand.

The limited manufacturing capacity of the Greenford Green works which became evident in 1873 seems to have caused some falling-off in the price of anthracene. In March 1874 T. D. Perkin made an estimate of the cost of manufacturing 34 tons of alizarin, which was about the monthly output, on the basis of raw materials cost supplied to him by Brooke, Simpson & Spiller. His figures are given in Table II, from which it is apparent that

TABLE II

Cost of Manufacturing Alizarin

Crude anthracene 25% quality @ 3s. 6d. 41 tons 14 cwt. at £87 10s. per ton ...	£3,648	15	0
Light oils 1,320 gal. @ 1s.	66	0	0
Chloride of Lime 28 tons @ £10	280	0	0
Hydrochloric acid 40 tons @ £3 5s. ...	130	0	0
Sulphuric acid 39 tons @ £9 per ton ...	351	0	0
Caustic Soda 13 tons @ £21 17s. 6d. ...	284	7	6
Sulphuric acid 11 tons @ £9	99	0	0
Ground Lime 32 yards @ 14s.	22	8	0
Soda Crystals 5 tons @ £6 10s.	32	10	0
Wages and coals required to produce color	498	0	0
	£5,412	0	6

anthracene was then costing 3s. 6d. per cent per cwt., equivalent to 87s. 6d. per cwt. of crude (25%) anthracene, or £87 10s. per ton. T. D. Perkin was quick to point out that the cost of alizarin as calculated in the manner described exceeded the real cost, because on part of the cost of raw materials, to the value of £1,266 5s. 6d., he would have expected a discount of 2½% for cash, thus reducing the cost to £5,380 7s. 5d. Evidently no discount was allowed on anthracene. A moment's calculation shows, therefore, that alizarin was costed at a fraction less than 1s. 5d. per lb.

In considering the above figures critically, it should not be forgotten that crude anthracene was unsuitable for the manufacture of alizarin. It was necessary to purify it, first by washing with petroleum spirit and afterwards by distilling it with caustic potash (the Montreal potash of the Stock List), as described in some detail by W. H. Perkin [5]. No provision for this seems to have been made in the above estimate, which is surprising in view of W. H. Perkin's own words: "For the economical production of dichloroanthracene we found anthracene which had been purified by distillation with potash essential."

Before anthracene was produced in commercial quantities by the tar distillers, Perkin & Sons were compelled to obtain it by the distillation of pitch. Many tons were distilled before rapidly increasing supplies of crude anthracene from the tar works made further operations of this kind unnecessary. Thus, 7,000 tons of pitch remained in stock at the end of 1873. It was regarded, however, as something in the nature of an insurance: "All or most of it", said T. D. Perkin, "was made before anthracene was produced by the tar distillers and had been bought for the purpose of extracting the anthracene it contained". To this end the works kept four retorts, but additional plant was in course of erection by November 1873 to increase the number of retorts to thirty. Perkin considered the pitch to be dead stock, which might be sold at either a profit or a loss. It was retained for working up in the event of a sharp rise in the price of anthracene. According to Richard Simpson the influence of this large stock of pitch on the anthracene market was "like keeping a bull-dog chained up".

As is well known, Perkin & Sons' alizarin process afforded a product which could be separated into two colouring matters, one greatly preponderating over the other. The major product, anthrapurpurin, or the "red shade", as it was called in the works, was the Alizarin (D.S.) of the Stock List, which cost 1s. 6d. per lb. to produce and for which the user paid 3s. 0d. per lb. at first and 2s. 3d. per lb. later. The more expensive brand, listed as Alizarin (T.S.) but more commonly known as the "blue shade", was held to be pure alizarin. Its cost to the works was 2s. 6d. per lb., but it was in great demand and sold at 5s. 6d. per lb.

Perkin's well known Britannia Violet is notably absent from the Stock List, at least under that name. As more than one "shade" was marketed, it may have been called, for stock purposes, Violet No. 1 and Violet No. 2. Indeed, this seems likely, in view of T. D. Perkin's statement to which reference has already been made: that Britannia Violet was produced until Perkin & Sons ceased to manufacture.

Magenta, it may be thought, cost Perkin & Sons surprisingly little at 6s. 3d. per lb., bearing in mind that it was quoted in Simpson, Maule & Nicholson's catalogue for 1866 at 2s. 6d. per ounce. When it first appeared on the market in 1859 it is believed to have been offered at the astounding figure of £3 3s. 0d. per ounce, more than 160 times its price fourteen years later.

There is a common belief that the discovery of Methyl Violet by Lauth in 1861 and its manufacture by Poirrier & Chappat in 1866 completely

TABLE I

Stock List, January 1874

	Tons	cwt.	qr.	lb.		£ s. d.
Crude anthracene	51	8	3	20		4,799 6 8
Recovered Do.	108				@ £45	4,860 0 0
Chlorine Do.	90				@ £10	900 0 0
Crude Do.	8	10			@ £35	297 10 0
Distilled Do.				42,280	@ 2/10	5,988 0 0
Pure Do.				1,030	@ 5/6	283 5 0
Chlorinated Do.				6,800		1,870 0 0
Pitch	7,000					13,717 0 0
Do. Oils	32				@ £10	320 0 0
Alizarin (D.S.) to Henderson & Co. ...				22,639	@ 1/6	1,697 18 6
Do. ,, J. Woodiwis... ...				11,085	,,	831 7 6
Do. ,, Laing & Co.... ...				6,941	,,	520 11 6
Do. ,, Chludow				2,700	@ 2/3	303 15 0
Do. ,, Koebel				3,913	@ 1/6	293 9 6
Do. B. (T.S.) J. Woodiwis				268	@ 2/6	33 10 0
Do. Laing & Co.				455	,,	56 17 6
Do. (D.S.) In Stock				22,900	@ 1/6	1,717 10 0
Alizarin "S" In Stock				3,720		279 0 0
Do. B. (T.S.) ,, ...				5,970	@ 2/6	746 0 0
Do. (D.S.) In work estimated ...				15,000	@ 1/6	1,125 0 0
Lake's No. 1				1,270	@ 2/–	127 0 0
,, Blue				70	@ 3/6	12 5 0
Lakes No. 2				1,060	@ 1/–	53 0 0
,, Carmine				10	5/–	2 10 0
,, Dusting				130	6d.	3 5 0
,, Wet				760	3d.	9 10 0
Violet No. 1				112	17/–	95 0 0
,, No. 2				382	13/–	248 6 0
Powder Color				128	11/–	70 8 0
Liquid No. 1			65 gal.		12/–	39 0 0
,, No. 2			60 ,,		10/–	30 0 0
Magenta				247	@ 6/3	77 3 0
Violet Liquid (T.S.)			50 ,,		@ 30/–	75 0 0
Mordtd. Violet				80	@ 1/3	5 0 0
Mauve Paste				120	@ 6/–	36 0 0
,, Liquid			14 ,,		@ 12/–	8 8 0
,, Paste in work				240	@ 5/–	60 0 0
Alumina				4,800		12 0 0
Black Paste				95	6d.	2 7 0
,, Powder		7			@ 10/–	3 10 0
Petroleum			2,570 gal.		1/4	176 0 0
Acetic acid			30 ,,		1/6	2 5 0
Acetate of Lime		11			65/4	36 0 0
Arsenic		1	0	14		1 2 0
Alum Cake	2	2	3	0	£8	17 0 0
Aniline	1	0	3	0	@ 1/3 per lb.	161 0 0
Do. Heavy		3	0	0	@ 4d. per lb.	6 3 0
Bromine				270	4/–	54 0 0
Bic. Potash	2	8	2	25	@ 8½d.	193 5 0
China Clay		18	0	0	4/–	3 12 0
Sal Ammoniac		5	3	0		12 17 0
Methy. Spirit			260 gal.		1/–	13 0 0
Coals	500				21/–	525 0 0
Manganese	5				£7	35 0 0
Caustic Soda		599	2	18	@ 23/9	713 5 10
Muriatic Acid	103	16	1	4	@ 65/–	337 7 0
Naphtha			530 gal.		@ 2/–	53 0 0
Do.			1,870 ,,		@ 1/6	140 5 0
Nitric Acid				1,125	@ 3½d.	16 8 0
Nordhausen Acid				1,020		25 10 0
Sul Acid				53,570		141 7 6
Sulphate of Potash		144			@ 8/–	57 12 0
Montreal Potashes		534			@ 35/–	934 10 0
Caustic Do.		40			@ 27/–	54 0 0
Residues Do.	250				@ £4	1,000 0 0
Chloride of Lime	58	5	1		@ £10. 13	620 0 0
Soda Crystals	7½				@ £6	45 0 0
						£46,984 2 6

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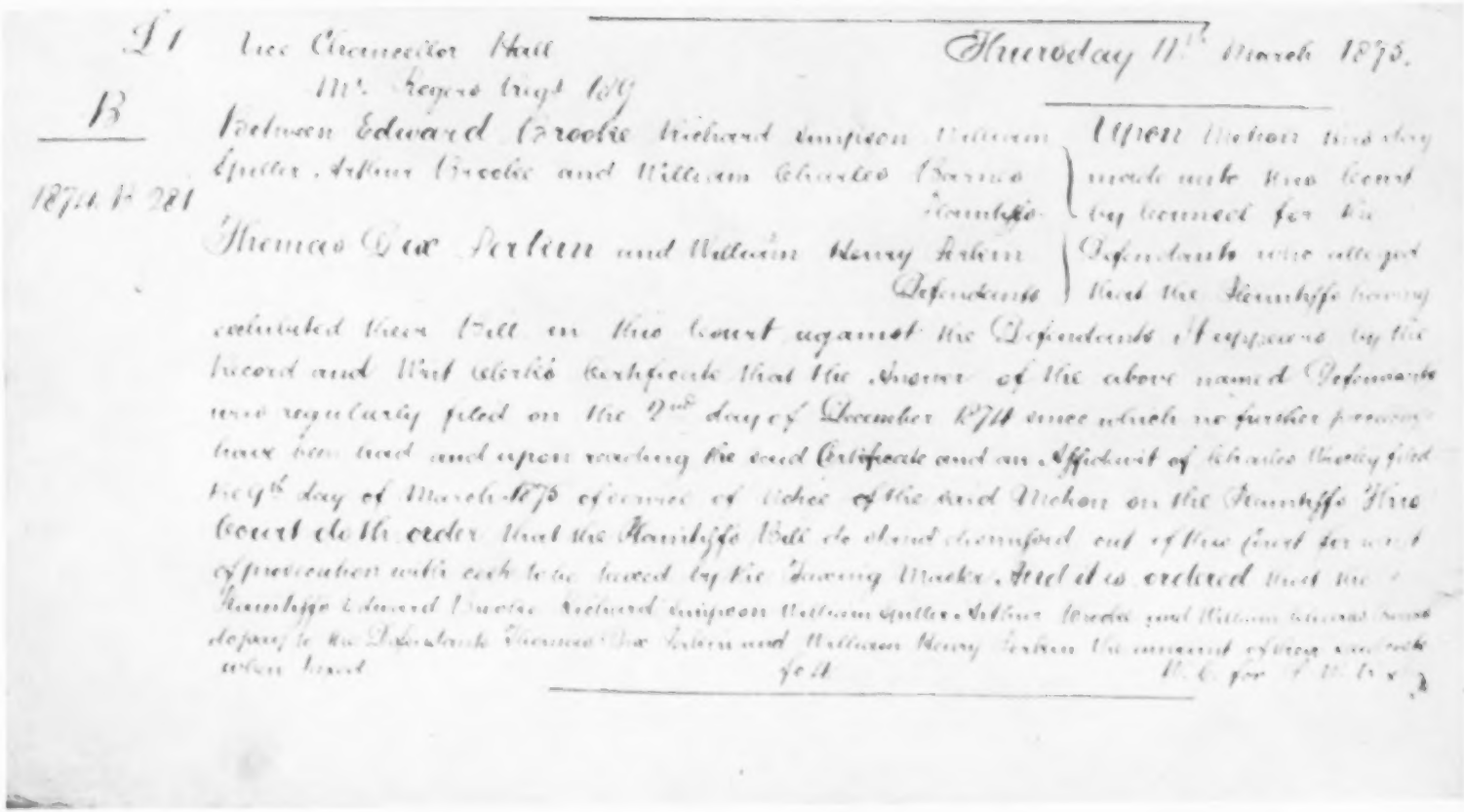
FIG. 1.—Group taken at Greenford Green before 1874. The middle three are T. D. Perkin, R. Williamson, and W. H. Perkin. The other two may possibly be the chemists Brown and Stocks. The original photograph has been recently presented to I.C.I. Dyestuffs Division by Henderson, Hogg & Co. of Glasgow.



Vice Chancellor Hall

Mr. Rogers Brgt 1874

Thursday 11th March 1875.

B

1874 B 281

Between Edward Brooke Richard Simpson William Sutter Arthur Brooke and William Charles Barnes Plaintiffs

and Thomas Dix Perkin and William Henry Perkin Defendants

Upon Motion this day made unto this Court by Counsel for the Defendants who alleged that the Plaintiffs having exhibited their Bill in this Court against the Defendants Thereupon by the Record and Writ Clerks Certificate that the Answer of the above named Defendants were regularly filed on the 2nd day of December 1874 since which no further proceedings have been had and upon reading the said Certificate and an Affidavit of Charles Hardy filed the 8th day of March 1875 of service of Notice of the said Motion on the Plaintiffs Firm Counsel this order that the Plaintiffs Bill do stand dismissed out of this Court for want of prosecution with costs to be taxed by the Taxing Master And it is ordered that the Plaintiffs Edward Brooke Richard Simpson William Sutter Arthur Brooke and William Charles Barnes do pay to the Defendants Thomas Dix Perkin and William Henry Perkin the amount of their costs when taxed

£1

W. C. for P. W. Brooke & Co

Public Record Office copy Reference C 33/1220 folio 404

Fig. 2— Dismissal of Plaintiffs' Bill of Complaint in the Action Brooke *versus* Perkin (1874)[9]

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eclipsed Perkin's Mauve. There can be no doubt that Mauve was at a disadvantage against its more brilliant rival and that sales were seriously affected. Yet it was still made at Greenford Green in 1873. What is called Mauve Liquid in the Stock List was almost certainly a spirit solution of the colouring matter. At 12s. 0d. per gallon, to which the solvent contributed 1s. 0d., the manufacturing cost of the dye was 11s. 0d., but because the strength of the solution is not recorded this figure has little meaning.

That the main effort at Greenford Green in 1873 was concerned with the production of alizarin is abundantly clear from the figures in the Stock List. It may therefore have occasioned T. D. Perkin small surprise that Brooke, Simpson & Spiller should abandon production of Mauve and Britannia Violet soon after assuming control of the works in 1874, as it is now clear they did.

Although Weldon's process for chlorine manufacture was worked on a commercial scale in 1869, it was never adopted at the Greenford Green works, although Perkin & Sons recognised its economic advantage. Indeed, W. H. Perkin may be quoted as saying: "We always intended putting down proper plant with Weldon's arrangement for recovering the manganese; but our attention then was so taken up with other matters that we kept putting it off and continued to use chloride of lime until we gave up manufacturing"[6]. T. D. Perkin gave it as his opinion that 1d. or 2d. per lb. on the cost of alizarin could be saved by adopting Weldon's process. He made this view clear to Brooke, Simpson & Spiller, but there is no evidence that his advice was taken.

Apart from Thomas Keith of Bethnal Green, the first dyer to purchase Mauve from Greenford Green, nothing seems to have been known until recently of Perkin & Sons' customers. It is now certain that Dick & Parker, Arthur & Co., and Sterling & Son were firms which bought large quantities of alizarin, but whether as agents or as users is not apparent. The most recent directories fail to disclose their names. The Stock List gives five additional names, of which Henderson & Co. is clearly identifiable with Messrs. Henderson, Hogg & Co. Ltd., of Glasgow, who are in business as chemical merchants to this day. Robert Hogg, who died just before the Jubilee Celebrations of 1906, was almost a life-long friend of Sir William Perkin, who placed great reliance on Hogg's knowledge of the madder and garancine trade. Their relationship is revealed by a letter which Sir William kept for many years—

26A, Renfield Street,
Glasgow. 28 April 1879

My dear Sir,

Many thanks for perusal of the second part of Graebe and Liebermann's paper returned herewith along with Messrs Bythway's[*] letter. The first part I shall return tomorrow.

In the second part the writers seem to record your researches less grudgingly than in the first part— this may however be owing to my being uninformed regarding the work done by you in the way of research after you ceased to manufacture.

Thanking you for your kind hospitality and with kind regards to Willie and George, I remain,

Yours faithfully,
Robt. Hogg

P.S. In regard to a statement at page 38 of G. & L's paper, we experienced less difficulty in introducing alizarin to Turkey Red dyers than we did with Printers.

According to a paragraph in an American newspaper fifty years ago, it was Robert Hogg's brother, John, who entertained Sir William Perkin to dinner at his home in Boston, Massachusetts, during the American Jubilee Celebrations of 1907.

Perkin & Sons' office methods were simple, but probably effective. Speaking to Edward Brooke, of Brooke, Simpson & Spiller, T. D. Perkin used something like the following words: "We did not keep our books by double entry or in fact upon any regular system, but had adopted the simple plan of a detailed ledger and invoice books with counterfoils, and a receipt and delivery book for the commercial part. As to the working books for the business, these were all kept on the decimal system, and the percentage yields were carefully noted; as far as we were able to do so, a debtor and creditor account was kept of all the materials used."

Perkin & Sons kept only one ledger, in which customers' accounts were entered, amongst them being that of Henderson, Hogg & Co.

The receipt books were said to resemble bankers' cheque books. In the wages book separate sheets were allocated to men engaged in the production of dyewares and chemicals, and to mechanics whose main task was the erection of new buildings and plant.

These few sentences tell all that is now known of Perkin & Sons' clerical methods. The books were at the disposal of Brooke, Simpson & Spiller for a short time after their acquisition of the works, in fact until the middle of February 1874. They were afterwards claimed by T. D. Perkin, and, even if they were not destroyed then or soon after, as one year followed another they may increasingly have assumed the aspect of lumber and suffered its almost certain fate.

Perhaps it is true that no less is known of Perkin & Sons than of any other contemporary firm of a similar nature. Perhaps, after all, it is not surprising, some eighty years after the furnaces were extinguished, that what is certain amounts to so little. There are those who think it hardly matters. Greenford Green and those who laboured there, however, have a real claim to remembrance in chemical industry.

* * *

The author gratefully acknowledges the help of Mr. P. C. Kirkpatrick and Mr. W. R. Kirkpatrick, grandsons of the late Sir William Perkin, who have so unreservedly placed at his disposal their private papers. Thanks are extended also to Dr. R. E. Fairbairn and Mr. D. Mason of the Library, Imperial Chemical Industries Ltd., Dyestuffs

* This is probably Messrs. J. T. & H. Bythway of Manchester, who were later one of the principal agents for the British Alizarine Co. Ltd., of Silvertown.

Division, for permission to reproduce the letter of Greville Williams.

IMPERIAL CHEMICAL INDUSTRIES LTD.
DYESTUFFS DIVISION
HEXAGON HOUSE
MANCHESTER 9

(*Received 19th February 1957*)

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[6] Idem, *ibid.*, 586.

Pacta Conventa—The Last Days of Perkin & Sons

W. H. CLIFFE

A study of the private papers of the late Sir William Perkin has enabled the first public account to be written of the terms of the sale of Perkin & Sons' Greenford Green works to Brooke, Simpson & Spiller. It is based largely on statements made in 1874 by Thomas Dix Perkin.

By the year 1873 it was clear that the demand for artificial alizarin was rapidly outpacing the manufacturing capacity of Perkin & Sons' works at Greenford Green. In 1869, the first year in which alizarin was made, the firm's production was 1 ton, but during succeeding years this increased to 40 tons, 220 tons, 300 tons, and a peak of 435 tons during the last years of Perkin & Sons' tenure of the works.

Until the end of 1873, so far as synthetic alizarin was concerned, the firm had scarcely any competition in this country. "When commencing to supply dyers and printers with artificial alizarin", said W. H. Perkin, "we knew that we had to compete with madder. And although the new product possessed certain advantages, yet we felt it was useless to ask prices relatively much higher than those of that product, and from the first we endeavoured to act on this principle"[1]. The German dye industry, freed from the responsibilities imposed by the Franco–Prussian War, turned to the production of synthetic alizarin with characteristic vigour, such that in 1873 it produced 900–1,000 tons, or more than double the output of the Greenford Green works. No doubt this still further depressed the price of natural madder, and possibly because of this, no less than the threat of German competition, Perkin & Sons reduced the price of their artificial alizarin towards the end of 1873.

The reasons for the sale of the works are too well known for reiteration. The firm was at the cross-roads and recognised the impossibility of long postponing a major decision upon its future. Heinrich Caro, friend of W. H. Perkin for many years and the man to whom the German chemical industry owed so much, gave his own views long afterwards in a letter to Professor Raphael Meldola, F.R.S.—

> Mannheim, 9th February 1908
>
> My dear Professor Meldola,
>
> . . . It is quite evident that in 1873, when their highly successful and lucrative pioneering work was done and the competition amongst the Alizarin manufacturers began to assume a daily increasing proportion and a more and more threatening aspect, that at that period the brothers William and Dix Perkin were called upon to reflect whether the foundations of their own manufacture were so firmly established as to allow them to build upon it a new and vast structure fitted out with improvements and capable of satisfying the immensely growing demand of the market. There was no possibility of remaining in the same condition and to rely on the protection of the British Patent Law to ward off the invasion of German Alizarin made at Höchst and Elberfeld in infringement of the joint Patents of Perkin and the Badische. The tide-wave could only be stemmed by offering to the British dyers and printers Alizarin equal in price, quality and quantity to the foreign make. At that time the selling price of Alizarin had already descended from its heights to a very low and daily lowering level, whilst the cost price of anthracene had increased. But more serious was the question of quality. The German manufacturers had done good scientific work and recognised the conditions by which the three constituents of artificial Alizarin, viz. Alizarin, Flavopurpurin, and Anthrapurpurin could be obtained at will from the corresponding mono- and disulpho acid of the Anthraquinone process and from Dichloranthracene, whilst Perkin, fatally prejudiced in favour of his Dichloranthracene process, had almost lost sight of the development of his original Anthraquinone process and had in turn become unable to satisfy the demand for Alizarin and Flavopurpurin. The brothers Perkin felt therefore in 1873 the urgent necessity not only of enlarging, but more so of entirely reforming and remodelling their manufacture in order to march at the head of the trade. But they must have also foreseen that their works had not only to be trebled or more and thoroughly changed, but altogether removed from Greenford Green and rebuilt in another more suitable place. The price and difficulty of obtaining Nordhausen fuming sulphuric acid and of from 20 to 40%— the only fuming acid known and used in 1873— was certainly a question of economy but of minor importance. The prosperity of Alizarin being past and gone, the brothers Perkin wisely sold their works to Edward Brooke, after we had declined their first offer in 1873.— Dr. H. Caro.

The negotiations leading to the agreement with the purchasers, Brooke, Simpson & Spiller, the price asked and paid, and the terms of the contract were never made public and have been the subjects of no little curiosity during recent times. It seemed vain to hope for information. The private papers of Sir William Perkin, of which acknowledgement has already been made[2], have, however, enabled a fairly complete picture of the sale to be drawn and published for the first time. What now follows is based mainly upon statements made by Thomas Dix Perkin, who, as the businessman of the partnership, assumed the chief burden of the negotiations leading to the final agreement.

It is held by some that Perkin & Sons were customers of Brooke, Simpson & Spiller, but this seems not to have been so, otherwise T. D. Perkin would not have written in 1874: "We were only

previously known to them as competitors in the manufacture and sale of aniline dyes—and they were scarcely known to us."* It was nevertheless admitted that Perkin & Sons had a personal transaction with Edward Brooke, but that was as early as 1862, when the latter was carrying on business under the style of Haworth & Brooke at Manchester. It seems a little surprising that the two firms had no closer relationship. Brooke, Simpson & Spiller were, after all, the successors in 1868 of Simpson, Maule & Nicholson, who were intimately associated with Perkin & Sons in business matters.

During the year 1873 Perkin & Sons received several offers from various people, whose names were not disclosed, to purchase their business or to enter into some form of partnership. Even earlier than this Brooke, Simpson & Spiller were desirous of widening their interests and increasing their trade by manufacturing artificial alizarin. This was difficult because of the patents held by Perkin & Sons and by the Badische Anilin- und Soda-Fabrik. So it is hardly surprising that, when Thomas Dix Perkin and Edward Brooke met in a railway carriage some time in 1872, the talk turned to alizarin and Brooke's eagerness to participate in its manufacture by the Perkin process. No definite offer was then made by either party, and, in fact, positive proposals did not shape themselves until November 1873. Even then they seem to have been made indirectly or through the services of an agent. T. D. Perkin evidently guessed the origin of these tentative proposals, for he asked his broker, Mr. Bowditch, who also acted as broker for Brooke, Simpson & Spiller, to make enquiries, at the same time informing him of that chance meeting in a railway carriage a year or more before. He also told Mr. Bowditch that he and his brother, W. H. Perkin, would be disposed to entertain a fair offer for their business, patents, and premises. "Our invention with regard to artificial alizarin", said T. D. Perkin, "had so increased our business that our premises were hardly sufficient for the manufacture of the amounts for which we had orders and we did not feel inclined to alter them or to take others. Moreover the business required in order to carry it on successfully almost incessant personal supervision and for these and other reasons we were desirous of parting with it at a fair price."

It may be that Perkin & Sons were considering means of increasing their capital and potential as an alternative to outright sale. An inconspicuous paragraph in a journal of the day disclosed the following: "We understand there has recently been a movement on foot for converting the concern of Perkin & Sons, the great patentees and manufacturers of alizarin, at Sudbury, into a Limited Liability, with a paid-up capital of £200,000."[3]

It seems that Mr. Bowditch communicated with Brooke, Simpson & Spiller, for on 19th November 1873 Edward Brooke wrote to T. D. Perkin a letter containing the following passage: "We have just had an interesting conversation with our mutual friend Bowditch, touching a certain matter ventilated a few days ago. Could you make it convenient to meet us here on Tuesday at 12 o'clock. If so kindly communicate with Mr. B. and we will be ready." The matter referred to was, of course, the proposed sale of the business, and this was the first direct communication between Perkin & Sons and Brooke, Simpson & Spiller.

On 24th November 1873, by arrangement with Mr. Bowditch, the first of several interviews took place when T. D. Perkin called at Brooke, Simpson & Spiller's counting house at 9 Fenchurch Street. At this meeting T. D. Perkin announced that he was entertaining proposals for the sale of the business from other parties, to which Edward Brooke replied that his firm was most desirous of entering the manufacture of alizarin. With that end in view he wished to reach some arrangement with Perkin & Sons. T. D. Perkin said that his firm had sold, or contracted to sell, all the alizarin the works were capable of producing during the coming year of 1874, which was only 350–400 tons. To Edward Brooke's enquiry as to what the price of the business was likely to be, Perkin said that he had in mind a figure of £100,000–120,000 for the business, patents, goodwill, and plant, and that stock, estimated to be worth £35,000–50,000, must be taken at cost price.

Brooke, Simpson & Spiller next asked at what price the alizarin to be manufactured during 1874 had been sold and what was the estimated profit. T. D. Perkin readily gave the required information, saying that the alizarin had been sold, or was in course of being sold, at 2s. 3d. per lb. and would realise a profit of £30,000. He added that the requisite anthracene, or material containing anthracene, was either in stock or contracted for in quantities amply sufficient to produce the 350–400 tons of alizarin which it was intended to produce during 1874. The actual cost of alizarin, said T. D. Perkin, should not, in his judgment, exceed 1s. 6d. per lb. In reply to Edward Brooke's enquiry whether there was a demand for more alizarin, T. D. Perkin said that he had no doubt that they could sell double the amount were the works capable of producing it. Although the works could be extended to some extent, they would even then be inadequate, and new works would have to be built.

The conversation then took a more general turn. Edward Brooke asked what T. D. Perkin considered to be the most important factors contributing to the successful conduct of the works. T. D. Perkin seemed disposed to discuss the matter with complete frankness. He said that the Greenford Green works, which covered about six acres, with a store and a laboratory on the other side of the road, had no means of drainage, and this was a great drawback. The purchase of crude anthracene was fully as important as the manufacture of alizarin, and much skill was needed in its selection. Manufacture was heavy [*sic*] and required one of the principals always to be on the spot. Indeed, said T. D. Perkin, no small part of their success was attributable to residence near the works.

* This provides the reason for the author's statement that Perkin & Sons probably purchased no Magenta from Brooke, Simpson & Spiller.

Edward Brooke was favourably impressed by what he heard, for he requested T. D. Perkin to terminate other negotiations in order that their two firms could come to a mutually satisfactory arrangement. The meeting ended with the fixing of another appointment.

Two days later, on 26th November 1873, T. D. Perkin, Edward Brooke, Richard Simpson, and William Spiller met for the second time at 9 Fenchurch Street. Not unnaturally, the main tenor of the conversation was profits. T. D. Perkin said that his firm had reduced the price of alizarin from 3s. 0d. per lb. to 2s. 3d. per lb. to counter the falling cost of madder and garancine. The effect would be that during the coming year of 1874 profit from the sale of alizarin would be about one-half of that of 1873, or about £30,000, for gross profits during the 27 months ended 30th June 1873 had been at the rate of £60,000 per annum. T. D. Perkin repeated that, providing good anthracene were purchased at a price not exceeding 3s. 6d. per cent per cwt. of pure anthracene, alizarin could be manufactured at 1s. 6d. per lb. Therefore by improving the process the cost could be made even less. In reply to a question from one of the partners, T. D. Perkin disclosed that Perkin & Sons had returned £35,700 for income tax for the year 1873–1874. He volunteered full information as to the patents held by his firm and the mutual licence held with the Badische Company, and said later when speaking of this meeting: "I again pointedly warned them of the absolute necessity of great and constant supervision and attention on the part of any person or persons purchasing our business and works. I told them by way of example that when I was absent from the works for only one week the production fell off and that during August, when I was on the Continent for three weeks, the production fell off to the amount of several thousands of pounds, and that this, as I believed, was caused entirely by my absence from the works." T. D. Perkin did not fail to record that Brooke, Simpson & Spiller spoke rather boastfully of the size and the importance of their own business and the excellence of their arrangements.

The price to be paid for the business was again discussed. T. D. Perkin said that he would require £35,000 for the plant, land, and factory and £75,000 for the patents and goodwill, making a total of £110,000 not including the stock at cost price. He observed that adaptation of the works to alizarin manufacture had been costly, and some part of the work was even then unfinished. Before reaching a decision Edward Brooke would be advised to inspect the works and processes. "I pointedly asked him to come alone, saying that I did so because I felt sure that he would not take advantage of anything he saw even though the proposed purchase fell through." An appointment was fixed for Friday, 28th November 1873. But before the meeting dissolved T. D. Perkin gave to Edward Brooke a paper containing one of three somewhat similar statements which he had prepared in readiness for the discussion. The statements differed in detail and need not be reproduced here, but some of the more interesting items may be quoted.

On 1st April 1871 the value of the freehold land and plant was estimated to have totalled £10,400. Another statement put the combined value of plant, land, stock, and cash on the same date at £25,000, from which it is seen that stock and cash together amounted in value to £14,600. Between that date and June 1873 new plant to the value of £31,600 was installed, and the total value of plant, land, stock, and cash on 1st July 1873 was £182,004, made up as follows—

Plant and land	...	£41,142
Stock... ...	...	48,959
Cash and debtors	...	97,953
		188,054
Less creditors	...	6,050
		£182,004

By deducting the 1871 value (£25,000) the figure of £157,004 represented the profits over 27 months, say at the rate of £70,000 per annum. The plant account at July 1st was augmented by £4,300, which represented the value of new installations up to October of the same year, and by a further £1,758 for additions up to December 31st, giving a total of £47,200. Sales from January 1873 to November 1873 were given as £116,793 14s. 7d. The statement also made it clear that stores on the other side of the road consisted of two buildings and nearly two acres of land, which would be let at £40 a year. The patents held by Perkin & Sons were briefly mentioned by T. D. Perkin as follows—

Patents United Kingdom:
One dated June 25 1869 [*] } held jointly with the
One dated ,, 26 1869 [*] } Badische Company.
One dated Nov. 1869 worked under licence from W. H. Perkin [*]
France: One (not certain if there are two)
America: One dated June 4 1872.

The statement concluded as follows: "Possession to be taken January 1 1874. T. D. and W. H. remain for say 6 months if required by B. S. & S. and undertake not to go into manufacturing alizarin and to submit any improvements they may discover in the manufacture of alizarin from anthracene to Messrs. B. S. & S. for their acceptance or refusal."

The third meeting between the principals of the two companies took place at 11.30 on the morning of Friday, 28th November 1873, when Edward Brooke and his brother, Arthur Brooke, arrived at Greenford Green. In company with Thomas Dix Perkin, Edward Brooke spent 45 min. touring the works. He expressed surprise that the difficulties of manufacturing artificial alizarin had been overcome in so short a time. The two men then returned to the office to join Arthur Brooke and W. H. Perkin and spent about 10 min. there. The prospective purchasers were given a pamphlet, which may have been a trade circular or a pattern card, demonstrating the effects which could be obtained by using anthrapurpurin (the "red shade") and pure alizarin (the "blue shade"). Afterwards, with the exception of W. H. Perkin, they adjourned to T. D. Perkin's house to take wine and biscuits, and left shortly before 1 p.m.

On the following Tuesday, Thomas Dix Perkin called at the offices of Brooke, Simpson & Spiller, where he received from Edward Brooke a form of agreement for the purchase of the business and the following letter—

9, Fenchurch Street,
London. Dec. 27/3.

Dear Mr. Perkin,

Herewith I hand you the Agreement. The amount is rather more than we expected but we are prepared to carry it out. I shall be in town on Monday and Tuesday and can meet you either day at 12 o'clock to settle the matter.

Faithfully yours,
Edward Brooke.

T. D. Perkin, Esq.
Greenford Green, Sudbury.

Two days later, on 4th December 1873, T. D. Perkin received a second letter, reading as follows—

Royal Crescent Hotel,
Brighton.
December 3 1873.

Dear Mr. Perkin,

My partners are quite prepared to endorse the agreement I gave you on Tuesday. All that I ask is that you will allow them first to see through your factory, say on Tuesday next. They have an equal interest with myself and the agreements can be signed and the deposit paid at your factory. Kindly drop me a line in reply to my address at Caen Wood Towers, Highgate, as I leave here in the morning.

Edward Brooke.

Thomas Dix Perkin, Esq.

It may seem a little surprising that negotiations involving the sale of a large works for a very substantial sum of money were so near conclusion and yet two of the three partners comprising the firm of Brooke, Simpson & Spiller had not even inspected what they proposed to buy. Edward Brooke was clearly their spokesman and was probably looked upon as the senior partner. There was further cause for surprise later in this somewhat strangely conducted business deal.

Between December 2nd and December 8th there was no personal communication between T. D. Perkin and Brooke, but two letters were written on the same day. The text of the longer is as follows—

Caen Wood Towers,
Highgate,
December 6 1873.

Dear Mr. Perkin,

We have made arrangements to leave Euston by the 10.30 train on Tuesday due at Sudbury a little after 11. Would it be too much trouble to kindly send a trap for us as it is rather a long walk from the station. So if I hear nothing from you to the contrary you may expect us and the thing can be settled without further delay.

Yours always,
Edward Brooke.

T. D. Perkin, Esq.

Without further delay! The first meeting of the two parties had occurred only twelve days before.

On that same day T. D. Perkin also wrote a letter—

Greenford Green,
Sudbury, Middlesex.
December 6 1873.

Dear Mr. Brooke,

I have your favor of the 3rd and should have written you sooner but for the negotiation that I named to you not being yet satisfactorily arranged. However I hope to see you on Monday if you are in the City say after 2 or 3 o'clock.

Yours very truly,
Thos. D. Perkin.

The nature or purpose of the negotiation referred to is not now known: it may have been concerned with putting to an end tentative arrangements with other prospective purchasers in accordance with Brooke's request of November 24th. This speculation receives some support from what was said shortly afterwards, when, on December 8th, T. D. Perkin called on Brooke, Simpson & Spiller to say that he considered all negotiations with others at an end and to agree to the suggested visit to the works on the next day.

On December 9th Edward Brooke, Richard Simpson, and William Spiller made a careful examination of all the buildings, plant, and manufacturing processes at Greenford Green. T. D. Perkin claimed afterwards that he gave the fullest information in his power. In repeating his earlier statement that the cost of manufacturing alizarin from the anthracene then belonging to the firm would not exceed 1s. 6d. per lb., he gave his opinion that a saving of 1d. or 2d. per lb. could be effected by adopting Weldon's process for generating chlorine. The partners asked what additional land was available for the erection of another factory. They were shown a field on the other side of the road which could be purchased at £220 per acre freehold. A goodly price in a rural area!

A singular feature of this meeting, as recalled by T. D. Perkin almost a year later, was that Brooke, Simpson, and Spiller made no allusion to books or accounts, much less asked to see them. Certainly they were not offered, but, said T. D. Perkin, they were in the office and he was ready to produce them on request.

After luncheon at T. D. Perkin's house, at which W. H. Perkin was present, Edward Brooke produced a copy of the agreement which had first been shown to T. D. Perkin on December 2nd. He offered £100,000 for the business, plant, and patents. Whilst W. H. Perkin demurred, saying that the price was £110,000, his brother said that the sum offered would be acceptable provided that the American patent was excluded from the bargain. Edward Brooke objected that they must have the patent and offered £105,000, which was accepted without further discussion.

The terms of payment were arranged by Edward Brooke, and it was settled that an agreement should be signed and a deposit paid next day at 9 Fenchurch Street. It was also agreed that T. D. and W. H. Perkin should visit Hackney Wick to advise on the possibility of extending the Atlas Works to manufacture alizarin, in particular the "blue shade".

On the following day, December 10th and only sixteen days after the first interview, an agreement was executed by the several parties in London. It was signed by Edward Brooke "for self and partners", but nothing is now known of the terms of this agreement. A deposit of £5,000 was paid, and T. D. Perkin is known, on his later admission, to have given his opinion that, if the purchasers increased the means of production and worked the business properly, they might expect to recover in two years all the money they were about to pay. Nothing seems to have been said about the cost

of increasing the means of production, which would certainly have been a very considerable sum.

An apparently unaccountable feature of this deal is that, according to a statement made by T. D. Perkin almost a year later which there is no reason to doubt, it was not until almost a fortnight later, on 23rd December 1873, that Edward Brooke asked to see the books of Perkin & Sons. "On that occasion", said T. D. Perkin, "he was in our private office and saw the books of our firm on the desk and said 'Are these your books? How do you keep them?'" It is impossible to avoid the impression that Brooke, Simpson & Spiller failed to observe the ordinary precautions which are to be expected in any normal business transaction of this nature. The integrity and the reputation of Perkin & Sons were unquestionable, but that cannot seriously be accepted as an excuse for Edward Brooke's apparent failure to safeguard the interests of himself and his partners. Had they no curiosity about customers' accounts or volume of sales?

On an unknown date after the signing of the agreement Brooke, Simpson & Spiller were joined by William Charles Barnes, the principal of W. C. Barnes & Co., Phoenix Works, Hackney Wick, who were dye agents at least in part.

On 1st January 1874 Brooke, Simpson & Spiller took formal possession of the Greenford Green works of Perkin & Sons. Five separate indentures were signed. The original intention was that the purchasers should pay £50,000 at once and the balance of £50,000 in two equal instalments at 3 and 6 months. By a last-minute decision they chose to make an initial payment of £65,000, less interest of £159 7s. 6d., which is clearly an apportionment at the rate of 4¼% per annum on £15,000. Payment of the balance of £35,000 was secured by a memorandum of deposit, by which Brooke, Simpson & Spiller agreed to make two equal payments of £17,500 on 1st April and 1st July 1874. Until receipt of the second payment the Perkins retained the conveyance to them of the freehold premises at Greenford Green, the title deeds, and the letters patent.

The stock held by Perkin & Sons, it will be remembered, was to have been taken at cost. It seems that at some time in December 1873 the original invoices were scrutinised and the weights of all material in work and goods unworked were assessed jointly by chemists of both concerns. Mr. James Thomas Brown acted for Perkin & Sons and Mr. Nickels represented Brooke, Simpson & Spiller. The stocktaking was carried out in accordance with the agreement of 10th December 1873 and there was no occasion for dispute. This is not to say that there were no difficulties. On December 30th, for example, it was found very hard to decide the value of the dye then in process of manufacture. On that day T. D. Perkin addressed a letter to Edward Brooke—

Greenford Green,
Sudbury, Middlesex.
December 30 1873.

E. Brooke, Esq.
My dear Sir,
I find that it will be very difficult to arrive at the value of the colour now in process of making and to have a satisfactory result a few days are required. Could it be arranged to stand over for say a week, all other matters can be settled on Thursday. Mr. Nichols [*sic*] has been over a large part of the stock and quite sees the difficulty as to color. I will call upon you at No. 9 Fenchurch Street tomorrow say about 11 o'clock and we can decide about this.
Yours very truly,
Thos. D. Perkin.

On the whole, there was no serious hindrance to the compilation of a substantially accurate stock list [7]. A provisional value of £47,000 was set upon it and agreed to at the meeting of 1st January 1874. The agreement concerning stock was formal and in part read: "Received the above-mentioned sum of £47,000 by the acceptance of Messrs. Brooke, Simpson & Spiller, Brooke and Barnes under the firm or style of Brooke, Simpson & Spiller for £11,750 each respectively payable at 9, 12, 18 and 24 months after this date. We confirm the above." Then followed the signatures of the five partners named above. The agreed value of the stock, however, was later increased by £1,948 13s. 6d. to cover the cost of dye in manufacture, but Brooke, Simpson & Spiller deferred payment of this additional sum, and it is questionable whether it was ever paid.

The two chemists who had served for a number of years with Perkin & Sons remained at Greenford Green under the new ownership. Each signed an agreement to stay five years at progressive salaries and a commission of 7s. 6d. per ton of alizarin produced in excess of 400 tons per annum. Whatever happened to Stocks, it is known that Brown terminated his employment somewhat precipitately, and in the light of what happened in 1874 at Greenford Green it is hardly surprising.

W. H. Perkin and T. D. Perkin faithfully observed the terms of the contract and assisted Brooke, Simpson & Spiller in the manufacture of alizarin until the end of June 1874. At least, to use T. D. Perkin's own words at a later date, "We assisted them as far as they were willing to accept our services." The new owners set their course on troubled waters, and their misfortunes form no part of this account.

* * *

For permission to reproduce Heinrich Caro's letter to Professor Raphael Meldola the author's thanks are extended to Dr. R. E. Fairbairn and Mr. D. Mason of the Library, Imperial Chemical Industries Ltd., Dyestuffs Division.

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(*Received 6th March 1957*)

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Litera Scripta Manet— The Alizarin Débâcle

W. H. CLIFFE

After Brooke, Simpson & Spiller purchased the business of Perkin & Sons they failed to realise their expectations in the alizarin field and eventually gave up the attempt. How they unavailingly tried to impose responsibility for their failure on W. H. Perkin and T. D. Perkin, even to the extent of recourse to law, is now recorded for the first time.

When Brooke, Simpson & Spiller signed on 1st January 1874 the contract of sale which gave them control of Perkin & Sons' Greenford Green works and the flourishing business which had been so successfully developed during seventeen years, their future seemed assured. They were experienced men of business, who had, since 1868, proved themselves worthy successors to Simpson, Maule & Nicholson at the Atlas Works in Hackney Wick. Yet two years later they not only parted with their newly acquired premises but also with the alizarin rights which they had professed to be so eager to secure. It is singular that they were willing to divest themselves in so short a time of a business which had profited Perkin & Sons to the tune of £60,000 a year.

After eighty years or more it is hard to decide how far the fortunes of the new venture were known outside the counting houses of the firms concerned, and no hint is to be found in the journals of the day. The truth is, however, that the year 1874 threatened to be disastrous for Brooke, Simpson & Spiller, at least so far as concerned their new responsibilities and ambitions. The only suggestion that all was not well seems to be found in an inaccurate account of an ill-remembered meeting with Sir William Perkin written many years after it took place[1]. It contained the following passage: " . . . and, before the end of the year [1874] those clever business men were complaining bitterly to Perkin that he had cheated them in the sale of his works and were wanting him to give them their money back, which as the old gentleman told me with a chuckle, he very positively and decidedly refused to do."

With an appetite thus whetted, the student of industrial history seems faced with little prospect of satisfying it. Nonetheless, the answers to his questions lie in the Public Record Office for all to see who will take the trouble of looking. The documents are coldly factual, but it is an unresponsive reader who fails to sense the personal feeling behind the legal phrase. It is easy to sense on the one hand the confidence, even complacency, of Brooke, Simpson & Spiller giving place first to chagrin and then to bitter anxiety; on the other, there is the dismay and indignation of the Perkin brothers, powerless to do more than watch the casting away of what they had built up so painstakingly over the years. It is a cheerless thought that two firms of repute, both controlled by men who were rightly esteemed and even honoured in the worlds of commerce and science, drawn together to conclude an honourable agreement, so quickly fell to accusations across a hedge of mutual suspicion.

William Henry Perkin and Thomas Dix Perkin freely placed their combined experience as manufacturers of synthetic dyes, particularly alizarin, at the disposal of their successors, Brooke, Simpson & Spiller. By agreement they were to remain at the Greenford Green works until 30th June 1874, giving any help in their power to facilitate transition from one ownership to another. Although they faithfully discharged their trust, the first chill breezes of disharmony were evident as early as the beginning of February of the same year. Despite the Perkins' protestations, one disquieting situation gave place to another, alarm followed alarm, until in September, with every prospect of disaster before them, Brooke, Simpson & Spiller tried to retrieve what they could from a well nigh hopeless situation by recourse to law.

On 21st September 1874 they filed in Chancery a Bill of Complaint[2] alleging wilful misrepresentation and praying for the rescindment of the agreement and indentures, to which both parties had freely subscribed barely nine months earlier.

By 2nd December 1874 W. H. Perkin and T. D. Perkin were prepared with the Answer of the Defendants[3], and a devastating document it seems to be. No doubt so it seemed at the time, for the action never went to court, Brooke, Simpson & Spiller prudently withdrawing their accusations. Their confidence in winning the day may have been shaken by what happened in October. On the third day of that month they were due to pay an instalment of £11,750, being part of the purchase price of the stock at the Greenford Green works. They failed to do so, and on October 6th the Perkins took legal action for the recovery of the money. On November 30th Brooke, Simpson & Spiller were forced to pay not only the sum due but also interest and costs. In view of the fact that during the years 1886–1900 they completed only seven British patents, it may be wondered whether they ever recovered from these reverses.

The real bone of contention between the parties was the cost of producing alizarin. It was alleged that all requests for production of Perkin & Sons' books and accounts, in order that the working expenses and profits could be established, were evaded, and that Brooke, Simpson & Spiller were in consequence without means of testing the accuracy of Perkin & Sons' statements. Because they had the greatest confidence in the integrity of those with whom they were negotiating, said Brooke, Simpson & Spiller, they forebore from insisting on an inspection of the books, preferring to rely on the honour of the Perkins. Countering this charge, Thomas Dix Perkin said that the plaintiffs were men of mature years and business habits, quite competent to take care of their own interest[3]. They bought the business on their own judgment after minute inspection, and their chemical knowledge enabled them to form an opinion of the value of the business. The whole transaction, he said, was a pure matter of business, in which he

never asked for the confidence of the plaintiffs or their reliance on his good faith. So far from his evading production of the books or being unable to produce accounts, he continued, they were in fact inspected by Edward Brooke on 23rd October 1873, and the latter paid particular attention to the account of Henderson, Hogg & Co. Brooke even asked for the invoice books to be sent away to be stamped in red with his firm's name as successors to Perkin & Sons. One may pause here to reflect that it would be odd indeed, in a business transaction involving close on £155,000, that the purchasers should be content to append their signatures to binding documents without taking the trouble to inspect the books of the concern they proposed to acquire. Some would think it hard to believe that "men of mature years and business habits" could be so imprudent as to neglect so obvious a precaution and such a bounden duty. If, in fact, Perkin & Sons had placed difficulties in their way, it is incomprehensible that Brooke, Simpson & Spiller should have continued the negotiations so confidently, as they certainly did. But this is no place for judgment or partiality.

It was alleged by Brooke, Simpson & Spiller that Thomas Dix Perkin advanced the attractive prospect that if the business were purchased the whole of the cost would be recovered in two years. They were induced to believe that during the ensuing year they could expect a profit of £30,000 on the alizarin sales and an additional and like sum from the business which would be likely to flow in at higher prices. In fact, receipts were greatly below these figures, and they subsequently discovered that the Greenford Green works had no greater capacity than 500 tons of alizarin a year. Countering these charges, T. D. Perkin said that it was made clear from the outset that the plant was taxed to the limit and that there was no prospect whatever of increasing output of alizarin without extension of the works or erection of a new works. There could be no question of discovering at a later date a fact which had been expressly stated at the beginning. He was, in consequence, quite at a loss to understand how Brooke, Simpson & Spiller could have permitted themselves to make the remark about an additional £30,000 of income, as that would be entirely dependent on erection of a new works. As to the profit of £30,000 on the sale of alizarin, T. D. Perkin did not seem disposed to think that there was need to argue the point: he had contracted to sell all that the works could produce during 1874 at a profit of 9d. per lb., so that the gain was a matter of arithmetic and not of opinion. He admitted that on signing the agreement on 1st January 1874, but not before as alleged, he had said that the purchase price could be recovered in two years, but only by means of increased production.

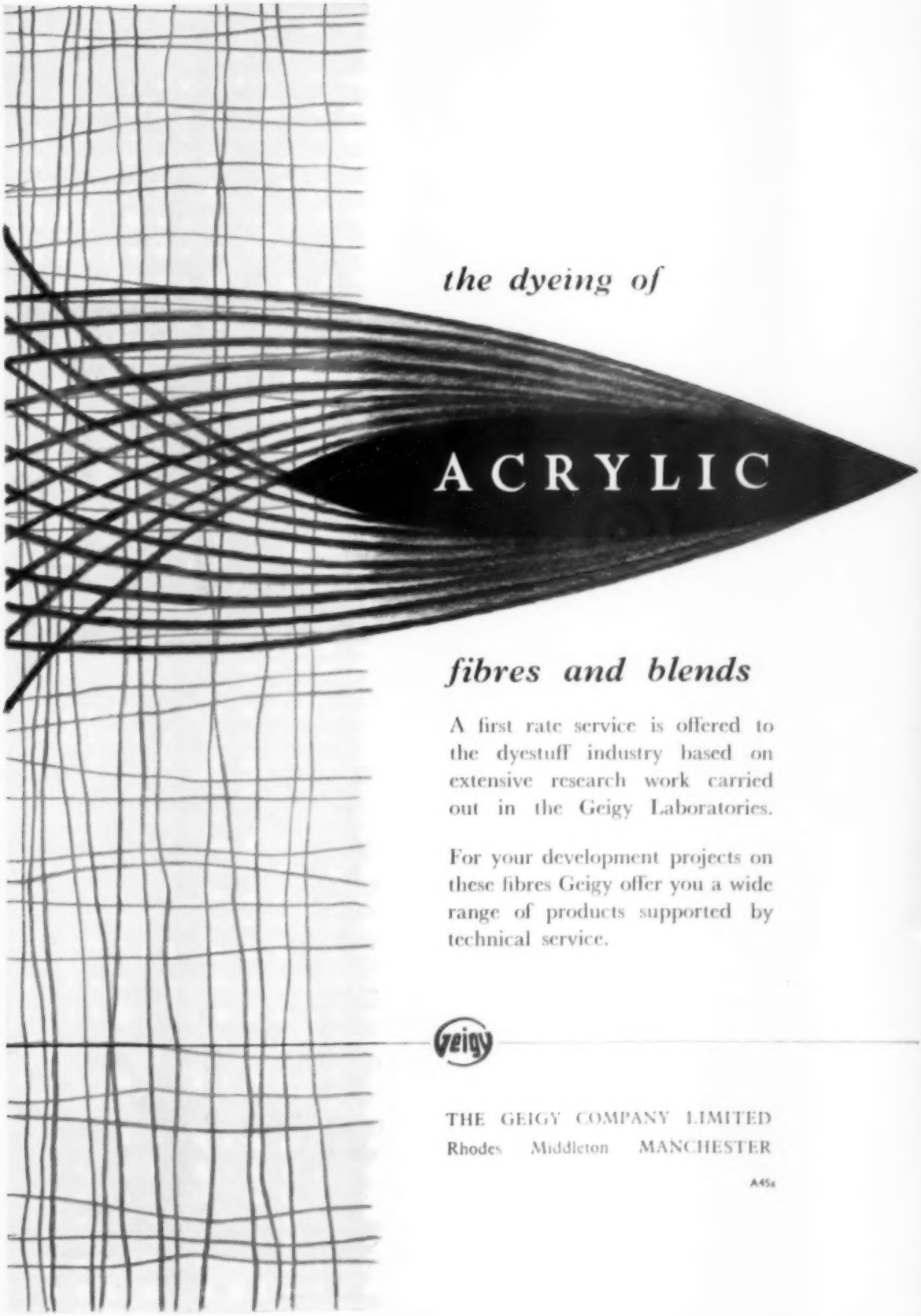
The plaintiffs then passed to a complaint about retorts. During a visit to the Greenford Green works on 9th December 1873 they had observed a row of about twenty-five retorts, which were said to be duplicates ready in case of need. On taking possession of the works they found all of them to be cracked and utterly worthless. So far from being duplicates, said T. D. Perkin, they were in regular use and were being cleaned out on the occasion of the visit mentioned, as was clearly evident from the presence of the tools. Admittedly one cracked and caught fire about the middle of January, but the rest were worked for about three months after Brooke, Simpson & Spiller took possession, and were even then dismantled only with the object of resetting them three to a furnace. Some were then found to be cracked, but not so badly as to prevent their being used: in any case, it was quite impossible to detect faults unless the retorts were dismantled. T. D. Perkin considered the charges in relation to the retorts to be not only far too sweeping but also without basis of fact.

Then there was a complaint about the stock of pitch, which amounted to 7,000 tons valued at over £13,000. It seems that Brooke, Simpson & Spiller, soon after taking over the works, attempted to dispose of the pitch, but found that it could be sold only at a loss. A letter was therefore addressed by Edward Brooke to Thomas Dix Perkin on 6th February 1874 the relevant part reading as follows—

> When I had occasion to call upon your solicitor Mr. Edell last week I took the opportunity of requesting him to draw your kind attention to the price charged for the large quantity of pitch you had in stock when we took the concern on 1st January and requested him kindly to submit the same to the notice of yourself and brother for re-consideration as to price. When I first visited your factory in November with a view to purchasing the business on behalf of my firm I remarked on the quantity of pitch in stock, when you replied, "It was all well-bought and I could re-sell it today at a profit of several thousand pounds." And this statement formed one of the many inducements you held out to us to purchase the concern and take the stock at cost price. On taking possession however we found we could not dispose of the pitch except at a loss instead of a profit of several thousand pounds, and indeed from enquiries since made, the quantity of 7,000 tons is almost unsaleable except by slow degrees and at a price considerably below what you charged us. As on purchasing your business we had to rely entirely on your verbal statements we confidently hope that we shall not appeal in vain for a considerable reduction upon the sum of £13,000, or perhaps, under the circumstances, you may not be indisposed to take the pitch on your own account and give us credit for the amount.

Thomas Dix Perkin replied through his solicitor, disputing the accuracy of the conversation referred to in the letter and refusing to make any concession in the price, although not closing the door upon further discussion. It was claimed, nevertheless, that exchanges were terminated abruptly by Brooke, Simpson & Spiller, who thereupon sold the pitch at a loss of £3,000. According to T. D. Perkin this was without the approval of their partner, William Charles Barnes, who admitted that the pitch had been sold on bad terms and at a bad price. T. D. Perkin not unreasonably argued that they were under no compulsion to dispose of the pitch in an unfavourable market, particularly as they were not obliged to pay for it under the terms of their agreement for two years. Relations between the two parties seem to have deteriorated from this moment.

Brooke, Simpson & Spiller renewed the attack from another quarter. They maintained that the



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stock-in-trade which they took over with the works at cost price was on the basis of Perkins' valuation. They were unable to check the cost price of any manufactured article, and contented themselves by sending a chemist to check quantities. This was vigorously denied: T. D. Perkin said that at no time was valuation made by themselves alone; it was done jointly by their chemist, Mr. Brown, and plaintiffs' chemist, Mr. Nickels, and there was never any disagreement. In fact, he said, the purchasers adopted their own course as to the taking and valuing of the stock and it resulted to their own advantage. The coal, for example, was underestimated by 350 tons, the chlorinated anthracene by 200 lb., and the pitch oils by 20 tons. The reader today can make his own calculation from the stock list[4] that the value undercharged to the purchasers was over £3,862. T. D. Perkin said that he made no additional claim, as he was content to abide by the agreement of January 1st.

Then there was a complaint about what was known as the "blue shade" alizarin. The alizarin made by Perkin & Sons was a mixture of anthrapurpurin and a second substance, which was pure alizarin but more usually called "blue shade". The latter could be separated from the mixture and sold for a higher price. Brooke, Simpson & Spiller contended that when they took over the works they inherited certain contracts for the supply of "blue shade" alizarin and that stocks fell far short of the amount needed to discharge their obligations. To make matters worse, they subsequently discovered that this brand of alizarin "had been prepared from some incrustations which had been found by the defendants on one occasion when they cleaned out some pressure tubes in which their alizarin had been heated and that the defendants had been unable (notwithstanding many attempts on their part) to manufacture successfully any more of the said "blue shade" save from the said incrustations which only accumulate in workable quantities at long intervals". It was alleged, in other words, that Perkin & Sons had concealed the source of the "blue shade" alizarin and that it could only be produced in limited quantities. One may think that this was indeed an astonishing charge. According to the stock list of 1st January 1874 there was no less than 6,693 lb. in store[4]. Could Brooke, Simpson & Spiller maintain that all this, to say nothing of what had been sold and delivered, had been got from mere incrustations? It is hardly surprising that T. D. Perkin was ready with a scathing reply: it was perfectly true, he said, that on one occasion, but on no other, a certain amount of "blue shade" was got from incrustations, but it was rather impure and was mixed with the main bulk for sale. It was absurd to say that they could not make it again: it was being done every day by simply separating it from the mixture coming straight from the plant. Brooke, Simpson & Spiller were well aware of this; they had seen it done, William Charles Barnes had assisted in the operation, and their chemist, Mr. Nickels, had been shown how to do it. How else could Edward Brooke have written: "The Germans are getting in with a 'rose' shade for which I find a good deal of enquiry. It seems to me that our ordinary colour with the blue left in will meet the case"? Whilst it was true, continued T. D. Perkin, that only about one-third of the contracted amount of "blue shade" was in stock, Brooke, Simpson & Spiller had of their own volition and against all advice entered into additional contracts. Any other difficulties were attributed to Edward Brooke's folly in ordering four new vacuum filters, which were needed for the "blue shade", and then not only failing to have them fixed but actually giving orders that no more of that material should be manufactured. That was the position, he said, when he ceased to attend at the works on June 30th.

It has already been said that the major difference between the two parties centred round the cost of producing alizarin. This needs closer scrutiny.

Perkin & Sons always maintained that alizarin cost the firm 1s. 6d. per lb. at the most to produce and that contracts of sale at 2s. 3d. per lb. less 6% had been signed for fulfilment during 1874. That was not the cost generally, said T. D. Perkin, but more particularly the cost of alizarin manufactured from the ample stocks of anthracene then held or anthracene of comparable quality and cost.

Six weeks after taking possession of the works, on 14th February 1874, and only two or three days after his failure to secure a concession in the price of the pitch, Edward Brooke wrote to the Perkins' solicitor to complain that experience showed the true cost of alizarin to be 1s. 11½d. per lb. He said that he would require a guarantee of profit at a minimum of £50,000 for the current year. Alternatively, he demanded refund of the first instalment of the sale price of the business, which amounted to £70,000, a return of the concern to the original owners, and payment of £5,000 for the trouble occasioned to him.

The defendants were of the opinion that, as Brooke, Simpson & Spiller did not begin manufacture of alizarin until January 17th, they could not in so short a time have data enough upon which to calculate the cost. Their solicitor replied on February 16th with a request for a statement showing how the figure of 1s. 11½d. had been reached. A statement was drawn up and shown on February 19th by Edward Brooke to T. D. Perkin, who said that the figures were wrong and offered to furnish a true statement proving the truth of his claim that alizarin cost no more than 1s. 6d. per lb. to produce. Perhaps in a genuine attempt to assist, Edward Brooke shortly afterwards sent a skeleton estimate with a request for T. D. Perkin to insert the necessary figures. T. D. Perkin made no attempt to use the document: he preferred to engage the services of an accountant.

On February 26th a meeting took place at which T. D. Perkin appeared to have expressed himself forcefully. What he said is best told later. It is of more interest at this stage that Edward Brooke produced a statement purporting to show how he had costed the alizarin. T. D. Perkin's considered

reply was: "The statement given by the Plaintiffs is entirely wrong and shows their ignorance of the quantity of materials and cost of labour required for the manufacture of artificial alizarin." His objections to the statement are too long to be reproduced here, but one or two examples of how much at variance the two parties were in their estimates are sufficient. In order to manufacture 34 tons of alizarin Edward Brooke claimed that 58 tons of anthracene was required, but T. D. Perkin said that this was excessive by 16 tons 6 cwt. The estimated quantity of sulphuric acid was 61 tons, compared with a true figure of 50 tons, and caustic soda was in excess by 3 tons. The combined cost of wages and coal, according to Edward Brooke, was £1,274: T. D. Perkin said that this was too much by upwards of £700. One may think that there is scarcely need to look further than this self-imposed burden to explain why costs ran high with Brooke, Simpson & Spiller. A curious feature of Edward Brooke's estimate is his description of the 34 tons of alizarin. He wrote of it as "containing 3 tons of Blue shade and 31 tons of ordinary shade". Yet he was later to assert that the "blue shade" arose wholly from incrustations accumulating in workable quantities at long intervals.

It was not long before T. D. Perkin's accountant completed his investigations. His findings were placed in the hands of the solicitor and communicated by him on 11th March 1874 to Edward Brooke. Only part of the letter need be quoted—

> As you had every opportunity of examining the accounts of the business as well before you agreed to purchase as afterwards and before the completion of the same and before you had taken possession of the works, Messrs. Perkin do not consider that they are in any respect bound to enter into the question of cost price but they have at considerable expense and trouble to themselves had a statement prepared from the books by the accountants referred to, a copy whereof I send you on the other side. This statement shows that the cost price [of alizarin] has been only £137 per ton or less than 1/3d. per lb. subject to an allowance being made for the depreciation of plant, repairs and rent which still leaves a considerable margin to make the cost price 1/6d. per lb.

It is impossible to say how Edward Brooke received this letter, but perhaps something may be inferred from the fact that an instalment of the cost price of the business amounting to £17,500 was paid on April 2nd without protest or objection. Possibly, Brooke felt himself to be on uncertain ground. At all events he wrote to the Perkins' solicitor on April 14th declaring himself anxious to be accurate in his estimates and suggesting that further discussions should wait until the end of June. It was at this stage that T. D. Perkin began to doubt whether Brooke, Simpson & Spiller really desired the business to be, or at least to appear to be, profitable. He was to express his doubt more strongly later.

At the end of six months' working Brooke, Simpson & Spiller alleged that alizarin had cost them 2s. 3d. per lb. to produce. As this was its contracted sale price, subject to a 6% discount, they were threatened with a loss of £3,000. They then took a step which seemed to be incomprehensible to T. D. Perkin. They presented a claim dated 31st July 1874 addressed to Messrs. T. D. and W. H. Perkin in the form of an invoice for 832,160 lb. of alizarin at 9d. per lb., amounting after certain deductions for material sold to over £30,958. Clearly 9d. was the difference between what they believed alizarin to have cost them and what Perkin & Sons had claimed to be the cost. The reply of W. H. Perkin was abrupt and declined any correspondence on the subject. Of this invoice it was said later[3]: "We cannot understand on what principle they can have made any such demand or what the meaning of this document is, for the Plaintiffs have never delivered any alizarin to us and had never even manufactured anything like the amount of 832,160 lb. at the date of the said document."

There are no known means available today of learning what happened at the Greenford Green works during the months which followed the despatch of that claim. One thing is undeniable: able men as the principals of Brooke, Simpson & Spiller believed themselves to be, they failed dismally in their alizarin venture.

As to the cause of this unhappy outcome, T. D. Perkin had not the least doubt and expressed his beliefs in no uncertain terms. The explanation according to him was as follows—

Manufacture of alizarin is heavy [*sic*]. To ensure success constant attendance at the works and close and regular personal supervision by the principals of the conduct and management of the business are essential. Although this advice was given on many occasions, Brooke, Simpson & Spiller wilfully neglected the works and managed it carelessly and injudiciously. They seldom went over the works or remained on the premises more than two or three hours at a time, and for many weeks none of the principals with the exception of William Charles Barnes visited the works for more than three or four days each week. Mr. Barnes was well intentioned, but his limited knowledge of chemistry was a hindrance to competent judgment. In consequence, it frequently fell to the managers or clerks to deal with an emergency or to receive and interview customers, which created a bad impression.

Of no less importance was the constant need to keep costs to a minimum. For example, said T. D. Perkin, his firm was accustomed to paying £228 a year for rates, taxes, and insurance. Brooke, Simpson & Spiller's balance sheet showed that during the first six months of 1874 those items had cost them £1,594 10s. 5d.

The plaintiffs bought much of their materials from relatives and friends, and a large part of it was unsuitable. Solvent naphtha was a case in point. Perkin & Sons had always purchased good-quality naphtha from Blott & Co. of Poplar. When stocks ran low, Mr. Barnes assumed responsibility for further supplies. The material which was delivered, charged T. D. Perkin, was quite unsuitable in that it contained a high percentage of naphthalene. Not only were the bungs covered with naphthalene, but naphthalene sublimed from the solvent during heating. Although Barnes said that he would return the naphtha, he omitted to do so. It was,

in fact, all used, and because dichloroanthracene was more soluble in low-grade than in good-quality naphtha, losses were high.

Perkin & Sons were accustomed to recover by steam distillation solvent naphtha which had been used to extract impurities from dichloroanthracene. The practice was discontinued by Brooke, Simpson & Spiller. Instead, dirty naphtha was allowed to accumulate until there was sufficient for a barge load, when it was sent for recovery to Mr. Barnes' private works at Hackney Wick. This method of working was condemned by T. D. Perkin as bad, risky, and costly. The quantity of naphtha in use was very much greater than was necessary. Many of the casks leaked to a dangerous extent, and much of the naphtha had to be pumped from the barge after it reached its destination. Then, again, distillation carried on away from the premises "prevented ascertainment of the condition of the naphtha residues and the quantity of chlorine oils they contained and which was one of the checks which we often observed in order to test the working of the chlorinating process."

When the works were controlled by Perkin & Sons, an adequate stock of coal was always maintained, which seldom dropped below 800 tons. It was asserted that Brooke, Simpson & Spiller stopped regular deliveries of coal and gave instructions for a reduction of stock. Whatever good reason there may have been for this, it seems to have been carried to excess. According to T. D. Perkin there was a state of emergency, which is best described in his own words—

> The Plaintiffs paid no regard to my advice and no coals were sent to the works until every ton of coals and even the coal dirt and dust from the four coal heaps (which had always been kept filled by us) had been burnt up. With such dust and coal dirt it was impossible to obtain the necessary heat or amount of steam necessary for carrying on the process so that production was slackened and great loss caused. After all the stock of coal had been used one barge load of coals was sent in and upon being used they proved to be utterly unfit for the work. But in spite of my remonstrances the same quality of coals continued to be sent. The loss caused thereby was so serious that I was urgent and constant in my complaint.

T. D. Perkin unburdened himself of more in this vein and referred to "an enormous loss of product".

Thomas Dix Perkin claimed that other protestations were similarly ignored. He emphasised the need for more steam and for additional evaporating plant if Brooke, Simpson & Spiller wished to push production to the maximum of which the works were capable, but without response to his advice.

A more serious criticism was levelled at the alleged failure to solve the problem of inadequate water supplies. Before the sale of the works Perkin & Sons had felt the need for more water than could be delivered from their well with existing equipment. They proposed to install new pumps, and in the meantime drew extra supplies of water from the canal. Brooke, Simpson & Spiller ceased to use the well and relied wholly on canal water, a practice which in itself may not have aroused criticism. But, said T. D. Perkin, instead of reclaiming a by-product of calcium chloride as Perkin & Sons had always done, Brooke, Simpson & Spiller discharged it into the canal. Despite analytical proof that the canal was fouled for a quarter of a mile beyond the works, they continued to use contaminated water with serious damage to production.

Another source of loss, according to T. D. Perkin, was the plaintiffs' negligence to ensure that all the dye-producing lime salt was boiled out of the lime residues. Laboratory analysis of the supposedly exhausted lime disclosed that it still contained useful material equivalent to 40–50 cwt. of dye each week, a fact which was brought to the notice of the chemist, Mr. Nickels, by T. D. Perkin in a letter dated 6th June 1874.

It was not only bad management, said T. D. Perkin, which contributed to the serious difficulties which encompassed the firm, but bad business methods. Apart from raising the price of alizarin soon after taking control of the works, which was reflected in higher charges for anthracene, Brooke abandoned Perkin & Sons' habit of prompt payment for raw materials which were purchased. In spite of the forfeiture of discount, Edward Brooke asserted it to be bad business practice. The firm issued a circular stating that it would in future require credit for general goods purchased. A similar circular to the anthracene suppliers warned them that time would be required before payment for the purpose of testing the anthracene delivered. It is possible to accept that Brooke, Simpson & Spiller's requirements in this respect were less unreasonable than T. D. Perkin was prepared to concede. But he was in no doubt as to what the effect would be. He did, in fact, say: "At the time the circular was proposed and before it was sent I warned Edward Brooke that its effect would be bad and prevent him and his partners from purchasing anthracene on good terms. The effect of the circular was in fact to make the tar distillers abstain from offering and indeed to make them refuse to advantageous proposals for the purchase of anthracene."

What has been written does not exhaust the charges levelled against Brooke, Simpson & Spiller. There is reason to believe that William Charles Barnes and the chemist, Mr. Nickels, did all they could to further the interest of their firm and to make a success of alizarin manufacture. The other principals, said T. D. Perkin, scarcely ever spoke to him upon any matters connected with business after the month of February. He professed to be quite at a loss to know why his advice and remonstrances were persistently ignored. No doubt as a result of continued exasperation, he gave his opinion that Brooke, Simpson & Spiller, after they had discovered that a successful alizarin business was impossible unless assiduous attention was paid to it, determined to make things appear as bad as possible, to lay the foundations for what he called extravagant and unrighteous demands.

It does seem very remarkable that Brooke, Simpson & Spiller should have demanded the return of the works and the business well knowing, as they must have done, that they had put it beyond their power to make such a return. Within their first year of ownership, according to T. D. Perkin, they had discontinued manufacture of

aniline dyes, particularly Mauve and Britannia Violet, and had lost the market; they had sold that branch of the business which was concerned with the manufacture of lakes and printing colours together with the processes; they had granted licences to various people to use the former patents of Perkin & Sons; they had worked out several contracts and entered into new ones. In addition, they had altered the works and gained a knowledge of processes and trade secrets whilst failing to maintain the sound reputation of the former owners. By raising the price of alizarin they had driven old and regular customers to make contracts for 1875 with Continental manufacturers.

Perhaps it took longer than expected for Thomas Dix Perkin and William Henry Perkin to prepare their answer to Brooke, Simpson & Spiller's demands. They applied for a further period of 14 days, and this was granted to them on 18th November 1874 [5]. On 10th December 1874 the plaintiffs required the defendants to make an affidavit of the documents in their possession relating to the case and to make them available for inspection [6]. The defendants countered with a similar order on 30th January 1875 [7]. There was not long to wait before the end of this unhappy affair. On 11th March 1875 the Court of Chancery ordered that the Plaintiffs' Bill should stand dismissed for want of prosecution and that the Defendants be awarded costs (Fig. 2) [8].

Whether Brooke, Simpson & Spiller made any attempt during 1875 to rehabilitate the alizarin industry at Greenford Green, or whether they made any attempt to alter their attitude of mind or to profit from their errors, is uncertain. In the following year they faced realities and parted with the works to Burt, Boulton & Heywood, who infused new vigour into the organisation. Not long afterwards the new owners transferred manufacture to their main works at Silvertown. It was from here, as a result of German blundering and the foresight of the Turkey Red Dyers' Association, that emerged the British Alizarin Co., which today forms part of the Dyestuffs Division of Imperial Chemical Industries Ltd.

* * *

The author gratefully acknowledges the assistance of Mr. D. Mason, Librarian of the Dyestuffs Division of Imperial Chemical Industries Ltd., in tracing documents in the Public Record Office.

Imperial Chemical Industries Ltd.
Dyestuffs Division
Hexagon House
Manchester 9

(*Received 6th March 1957*)

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[1] Pellew, Charles E., *Dyes and Dyeing* (New York: McBride Co. New and enlarged edition 1918).
[2] Public Record Office. Bill of Complaint, Action Brooke *v.* Perkin (1874 B 281: *Chancery Pleadings* C 16/916/281).
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[4] Cliffe, W. H., J.S.D.C., **73**, 316 (July 1957).
[5] Public Record Office. Action Brooke *v.* Perkin (1874 B 281). *Chancery Decrees and Orders* C 33/1211/2745.
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[7] Public Record Office. Action Brooke *v.* Perkin (1874 B 281). *Chancery Decrees and Orders* C 33/1220/86.
[8] Public Record Office. Action Brooke *v.* Perkin (1874 B 281). *Chancery Decrees and Orders* C 33/1220/404.

CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents

Paper Chromatography of Disperse Dyes

With reference to the recent paper on this subject [1], I would like to describe a new method developed and used in our institute. This method is based on the hypothesis that, for separation of a mixture by chromatography to be achieved, the substrate must have affinity for the components of the mixture under the experimental conditions. In the case of chromatographic paper and disperse dye dissolved in an aromatic solvent, the affinity is very low. We therefore attempted to increase the affinity of the paper by partial acetylation. We have found that, on a chromatographic paper acetylated to a content of about 30% of combined acetic acid, a very good separation of disperse dyes is possible. The chromatographic paper is treated in an acetylating mixture containing—

20% Acetic anhydride
75% Glacial acetic acid
5% Anhydrous zinc chloride

for 18 hr. at 35°c. in a closed vessel, washed, dried, and cut into strips. On the paper so prepared we have chromatographed many disperse dyes by the descending method, using chlorobenzene as solvent and eluant. A very good separation of many commercial mixtures has been achieved under these conditions in 1 hr. on relatively short chromatograms (20 cm.).

J. Janoušek

Institute for Textile Finishing
Dvůr Králové n.L.
Czechoslovakia

18th May 1957

[1] Elliott, K., and Telesz, L. A., J.S.D.C., **73**, 8 (Jan. 1957).

Notes

Meetings of Council and Committees

June

Council— No meeting

Publications— 18th

Deaths

We regret to report the loss by death of Messrs. J. H. Nuttall (a fifty-year member), L. P. Rendell, and E. A. Swift.

Greetings from Japan to the Perkin Centenary

A scroll has been received from the Japan Chemical Association, conveying in Japanese (see illustration facing p. 303) greetings to the Perkin Centenary. The following is a translation of the message—

> On the occasion of the Perkin Centenary, I take pleasure in expressing hearty congratulations on behalf of the Japan Chemical Association.
>
> The synthetic organic chemistry of the present generation and the wonders of its industries illustrate the unfathomable depth of the potentialities of science and make us fully conscious of the meritorious services of a great man.
>
> The discovery by William Henry Perkin of Mauve, a century ago, not only gave rise to a new field of dyes, but also brought about a great development of aromatic chemistry, which covers a great part of the field of organic chemistry. It also served as a bountiful mother to aliphatic chemistry, which subsequently followed it. All this, we believe, proclaims the immortal glory of Perkin.
>
> The hundred years of achievement of the perfect harmony of pure chemistry and industrial chemistry have given humanity untold welfare and comfort, while implanting in us the hope and courage for our further part in the future of science, which is marching vividly on.
>
> Indeed, the Perkin Centenary is most significant. We take this opportunity of saying that we are very anxious to do all possible in the cause of world peace and the happiness of mankind, working side by side with worldwide chemists and scientists.
>
> From far away here in Japan, we wish every success to the Perkin Centenary.
>
> H. Inouye
> *President of the Japan Chemical Association*

Annual Meeting of Section Officers

The Annual Meeting of Chairmen and Honorary Secretaries of Sections was held at Grosvenor House, Park Lane, London, on Friday, 29th March 1957, under the chairmanship of Mr. L. M. Wood (Honorary Secretary of the Society). Among the topics discussed were the use of projectors and tape recorders, the publication of practical papers and monographs, and the presentation of certain lectures to several Sections. A list of lecture titles offered by various firms, later extended to 53 titles, was considered, and attention was directed to the strain on the laboratory staffs of the larger firms imposed by the presentation of a large number of lectures. A suggestion was made that meeting cards should include brief synopses of lectures.

Reports of Sections for 1956-1957

HUDDERSFIELD SECTION

We have great pleasure in reporting another successful session, and our membership has shown a gratifying increase.

As in the past, we have had a joint meeting with the Huddersfield Textile Society, when Mr. Morse-Brown took us through the ages and the influence of history on fashions. The joint meeting with the Royal Institute of Chemistry was our first lecture of the session, when Mr. B. Kramrisch again visited us and provided us with very instructive details on the application of dyes to acrylic fibres. We held five other lectures, all of very high quality, with up-to-the-minute information on several subjects. As in the past, your Committee has endeavoured to provide a syllabus that will suit the practical man in this district.

We have also had two visits, one to Shell Chemicals, Stanlow, and the other to Messrs. Stevenson's (Dyers) Ltd. of Ambergate. Both were well attended and enjoyed.

Our Annual Dinner in November was not so well attended, but we were privileged to have the President of the Society with us on that occasion, also the entertainment provided by our Leicester friends, Messrs. Alf Carpenter & Co.

The report cannot conclude without thanking all members of the Committee for their co-operation.

Horace Turner
Honorary Secretary, Huddersfield Section

LONDON SECTION

The programme for the session has consisted of six lectures given in the rooms of the Royal Society, three being joint meetings with the London Sections of other technical societies, namely the Textile Institute, the Guild of Dyers and Cleaners, and the Clothing Institute. This last was the first joint venture with the Clothing Institute, and it proved a successful innovation. In addition a meeting was again held at Luton.

The Fourth London Lecture, given by Mr. James Laver (Keeper of the Departments of Textiles and Engravings, Illustrations and Design, in the Victoria and Albert Museum) on *Colour in Fashion*, was of the excellence now associated with this series, and attracted an audience of over 300. A noteworthy feature of the session has been the record attendances at the lectures in London and Luton.

Owing to petrol rationing the Dinner and Dance arranged for January was cancelled, but as usual a dinner was held following the Annual General Meeting of the Section.

The Perkin Centenary Essay Competition met with a most disappointing response. No entry was received to merit the full award offered, but a consolation prize of five guineas has been given.

There has been a decline in the rate of enlistment of new members, and it seems that a special

effort will be necessary to obtain a continued growth of the Section.

The election of Mr. R. C. Oakley to a Vice-presidency of the Society has given much satisfaction to members of the Section.

In conclusion, the appreciation of the Section is expressed to our Chairman, Dr. H. W. Ellis, who has served us so admirably during his term of office.

H. W. Taylor
Honorary Secretary, London Section

MANCHESTER SECTION

Eight meetings have been held in Manchester this session, with no external or joint meetings. The members of the Section were, however, invited to two meetings of the Textile Institute. The average attendance at the Section meetings was of the order of eighty members.

In view of the forthcoming Symposium at Buxton, the Section's one-day Symposium for 1957 was suspended.

The Junior Branch has had a most disappointing year as regards attendances. A re-organisation of the Branch has been initiated.

The Annual Dinner and Dance was held at the Midland Hotel, Manchester, on Saturday, 16th February 1957. Two hundred and fifty members and guests attended this successful function.

It is with regret that we record the deaths of Messrs. A. Chadwick, D. Howarth, R. Walker, E. N. Walters, and a prominent member of the Section Committee and Member of Council, Mr. C. P. Tattersfield.

The Committee wishes to acknowledge the past services of its retiring members, Messrs. J. Boulton, H. R. Hadfield, and G. S. J. White.

The Section is honoured to record the following awards made in 1956 to three of its members—Dr. P. W. Cunliffe (Bar to the Society's Gold Medal), and Mr. J. G. Grundy and Mr. K. McLaren (Silver Medals of the Society).

During the past year the Section increased its membership by 55.

K. Meldrum
Honorary Secretary, Manchester Section

MIDLANDS SECTION

The activities of the session just concluded have been well up to the level of previous years. In all, ten lecture meetings have been held, at Nottingham (3), Loughborough (3), Leicester (2), Derby, and Kidderminster. In the last two cases we continued our friendly co-operation with the local branches of the British Association of Chemists and the Textile Institute; a new departure was a joint meeting with the Society of Chemical Industry in Nottingham. The Section was further honoured by being selected as host to the Mercer Lecture held in Leicester. Our Perkin Celebration Dinner Dance (where mauve ties and lavender vests were *de rigueur*!) and our Annual Dinner once more emphasised the happy comradeship of the members.

After a splendid start to the session, lecture attendances fell sharply with the advent of petrol rationing; this is quite understandable when it is considered that, at any Midlands meeting in normal times, up to 40% of those attending may have made return journeys of 50 miles or more. In round figures, the average attendance fell from 100 to 60.

Membership increased by 17 to a total of 317 (new members 20, transfers to Section 9; *less* resignations 6, transfers from Section 5, death 1).

A glance at the list of Vice-presidents, Members of Council, and the various Standing Committees of the Society (published in this issue) shows that members of our Section continue to take a good share in the varied activities of the Society. One name is now sadly missing, that of Allan Tyler, whose sudden death in August last came as a severe blow to the Society at large as well as to the local Section. A tribute to his life and work has already been published in the *Journal* (**72**, 584 (1956)).

Mr. C. A. Mills now retires after two happy years in the Chair of the Section and is succeeded by Mr. A. W. Carpenter. This involves a change in the Secretaryship, and Mr. John Rayment steps into this position with the full confidence of the Section.

Changes have also taken place on the Committee. Mr. S. R. Meadows has expressed his wish to retire after a considerable period of service, during which he has made a substantial contribution to the remarkable growth of the Section. His action emphasises the general desire of the Committee that younger men should be given the opportunity to serve with them. As Dr. A. Datyner is shortly leaving the Section and there was a casual vacancy caused by the death of Mr. A. G. Tyler, the Annual General Meeting took full advantage by electing Messrs. D. O. Douglas, J. C. Hawley, and D. B. Williamson. Messrs. R. Fernsby, G. Whitehead, and J. C. Wright were re-elected.

In laying down his pen, the writer wishes publicly to acknowledge the friendly and enthusiastic support of the Section during his years of Secretaryship; without this, what has proved to be a very happy period of his life might merely have been an arduous duty. He is notably richer by the personal friendships formed with the Chairmen under whom he has served. He would also particularly acknowledge the interest and practical help shown to the Section by the Officers and Staff of the Society and the friendly co-operation of the Honorary Secretaries of the other Sections.

A. W. Carpenter
Honorary Secretary, Midlands Section

NORTHERN IRELAND SECTION

We gave prior consideration to Perkin Centenary celebrations this session, and on 28th September 1956 held the Perkin Centenary Ball at Woodbourne House Hotel, when there was an attendance

of 180 members and their friends. This function, which was a Dinner Dance, was very enjoyable. An excellent lecture, *The Life and Work of Perkin*, was given in Belfast by Mr. John Boulton on 14th November 1956. There was a large and appreciative audience for this Perkin Centenary Lecture, which was followed by a buffet supper. A prize of five guineas was put up by this Section for the best paper by a textile student on *The Influence of Perkin's Discovery on the Textile Trade*. There was an excellent entry, and the prize was won by Mr. R. V. Kirkpatrick.

Other Section activities included a total of seven technical lectures, two of these being held in conjunction with the Textile Institute. There were six committee meetings during this session.

The golf tournament was held in June 1956 at Dungannon Golf Club. There was a good attendance of members and their friends, and a very pleasant day was spent at Dungannon.

The Annual General Meeting and Dinner were held on 16th March 1957. We had the pleasure of having as guests at our Annual Dinner our President, Mr. Clifford Paine, and the Chief Whip of the Northern Ireland Parliament, Mr. Brian Faulkner.

One of the pleasing features of this session has been the good increase in Junior membership, which has resulted in a slight overall increase in membership.

JAMES PORTER
Honorary Secretary, Northern Ireland Section

SCOTTISH SECTION

During the session eight lecture meetings have been held in Glasgow, including a joint meeting with the local section of the Textile Institute. The Ladies' Evening was very successful and particularly well supported.

In connection with the Perkin Centenary Celebrations, a lecture by Professor John Read, *The Life and Work of Perkin*, was given in October, and a Dinner Dance was held in September. We were extremely pleased to welcome officials of the Society at the latter function.

One of the most gratifying features of the session has been the formation of a Junior Branch in Paisley. At the inaugural meeting some thirty members were enrolled, and the following officers were elected—

Chairman	... ...	Mr. R. A. Peel
Vice-chairman	...	Mr. C. McNeil
Honorary Secretary	...	Mr. R. McDonald

Ordinary membership now stands at 206. Whilst 14 new members were enrolled during the session, these were partly offset by removals, resignations, etc.

At the Annual General Meeting of the Section Messrs. R. S. N. Brown, G. Halley, J. G. B. McCallum, and J. A. Young retired from the Committee by rota, and as no other nominations had been received, these gentlemen were re-elected. Mr. W. G. B. Grant was elected Chairman, and Mr. J. G. B. McCallum Vice-chairman.

This report cannot be concluded without expressing appreciation to our retiring Chairman, Mr. C. D. Smith, and all Members of the Committee, without whose help the session could not have been so successful.

F. ATACK
Honorary Secretary, Scottish Section

WEST RIDING SECTION

During the present session, the Section has held two special lectures and a ladies' evening to mark the centenary of the discovery of Mauve by William Henry Perkin, in addition to its usual activities.

Under the Chairmanship of Mr. C. W. Green the Section has held a discussion on detergency and six lectures on a range of subjects including new approaches to dyeing both for wool and for cotton and the newer man-made fibres.

Two other Section events, the Supper and Smoker and the Ladies' Evening, were very successful, thanks to our Social Secretary, Mr. R. Hullah. Average attendance at lecture meetings was 65, which is a slight improvement on last year.

The Committee was sorry to lose the services of Mr. G. E. Styan as Honorary Secretary, part way through the session; they thanked him for past services, and hoped that he would continue to serve on the Committee. Miss Esmée Smith was nominated by the Committee to fill the vacancy.

The closing date for receipt of papers for the competition for West Riding Juniors, based on the Dyers' and Finishers' Association annual award, is 30th April 1957, so the award will not be made until early next session.

The Section Committee has met on five occasions.

ESMÉE SMITH
Honorary Secretary, West Riding Section

Dinner to Mr. Sidney R. Meadows

A Dinner held at the Kings Head Hotel, Loughborough, on Wednesday, 29th May 1957, was attended by twenty-one past and present members of the Committee of the Midlands Section. Mr. H. C. Olpin, on behalf of the Committee, presented Mr. S. R. Meadows with a gift of record tokens, and thanked him for all the enthusiastic support he had given to the Section in the past, both on the Committee, on which he had served for so long, and as an ordinary member of the Section. Mr. Olpin expressed the hope that Mr. Meadows would be happily associated with the Section for many years to come.

Asociación Química Textil

The *Boletín Técnico Informativo* of the Asociación Química Textil of Argentina in its first issue contains papers on antistatic agents, qualitative analysis of textile fibres, and the dyeing of viscose rayon cloth of irregular quality. The production is, as yet, modest, but nonetheless informative, and the Society extends its best wishes for the future success of the Association and its *Bulletin*.

New Books and Publications

Chemie und physikalische Chemie der Textilhilfsmittel

Band II

By Herbert Frotscher. Pp. 174. Berlin: VEB Verlag Technik. 1955. Price, DM. 15.00.

The first volume of this work was reviewed in this *Journal* in 1955 (**71**, 615). It dealt with the physical chemistry of fibres with special reference to the processes they undergo in textile works, but mainly with the physical chemistry of surface-active substances and their use in such processes. The present volume deals with the textile auxiliaries themselves but in the same style, namely their chemistry and physics in relation to their effectiveness. It covers in detail the oils and soaps used in the processing of wool, and also the auxiliaries used in the processing of cotton, rayon, polyamide, and other fibres, even glass fibres.

The main part of the book, however, is devoted to the chemistry and physics of the substances used in finishing, with special reference to the "superfinishes" (*Hochveredlung*) so much in vogue at the present time. The theories of the action of these substances are not always complete, but this is no criticism of the book, which gives these theories for the reader to accept or reject according as they agree or not with his experience. They will certainly help the book to be a great stimulus to the scientific finisher. It is very useful, too, to have in the book the chemical compositions of substances which at present are far better known by their trade names.

The book concludes with a good list of literature references and patents where the reader can find more detailed information on any particular topic.

Dr. Frotscher has really done a very useful piece of work.

R. Gaunt

Chimie des Peintures Vernis et Pigments

Edited by G. Champetier and H. Rabaté. 2 vol. Pp. xv + 661 and xviii + 633. Paris: Dunod 1956.

These volumes are the first to appear in a new series which is designed to cover the whole field of paints, varnishes, and pigments. To follow them will be two volumes on physics and separate books on manufacture; testing and conditions of use; history; and a special volume on the French paint industry. If the subsequent volumes reach the same standard as those under review, the total work will be a comprehensive encyclopaedia of paint technology of international interest.

The two volumes are made up of monographs by thirty-seven experts in the following fields—macromolecular chemistry, drying oils, cellulose, vinyl polymers, coumarone and indene alkyd resins, maleic resins, epichlorohydrin resins, rubbers, silicones, colophony, other natural resins, driers, turpentine, solvents, emulsifying agents, printing inks, metallic pigments, mineral pigments, organic pigments, dyes, extenders, carbon black, speciality chemicals, and waxes.

With so many authors, the editors have obviously had to make considerable efforts to preserve some uniformity of level and style. This has been achieved with no little success, and such failures as occur are probably unavoidable. For one thing, the present state of knowledge in such widely diverse fields must differ very considerably. With several of the natural raw materials discussed the reader is left wanting further information—which probably does not exist. On the other hand, where there is a wealth of information, as on synthetic resins or on organic pigments, specialists will consider the contributions to be inadequate, but limitations of space must be applied to keep the chapters reasonably proportionate. These are obvious difficulties, however, and must almost invariably be encountered when a wide technological field is to be covered.

A further difficulty has been introduced by planning the division of the total work into the volumes previously described. Frequently the reader has the impression that the authors are withholding relevant explanations, so that the subject may be continued serially, as it were, in the physics and manufacturing volumes. This makes the treatment of surfactants and antifoaming agents, for example, rather meagre.

The books are excellently printed and illustrated, but one feels that the light-coloured cloth bindings, though attractive, will suffer in paint laboratories. Also, since no index is provided with these first volumes, an overall index including forthcoming volumes would be worth consideration.

Nevertheless, these limitations do not seriously affect the considerable value of the work. It is encouraging to note the number of industrial organisations which have taken part, through their contributing representatives. French scientific works are making considerable advances at present, and their authors—although requiring a long phrase to convey a meaning, which some German writers would compress possibly into one composite word—never leave the reader in doubt. This clarity, coupled with the *lingua franca* of technology, makes the two volumes quite easy to read.

S. R. Cockett

Abstracts from British and Foreign Journals and Patents

The titles of abstracts may be modified. Abbreviations of names of firms are listed in J.S.D.C., **68**, *23 (Jan. 1952) and also, together with symbols and the periodicals abstracted, in the annual index*

I—PLANT; MACHINERY; BUILDINGS

Fourth Annual Fundamentals of Chemical Engineering Review

Ind. Eng. Chem., **49**, 538–626 (March 1957, Part II)

Developments during 1956 in the following subjects are reviewed briefly, and comprehensive bibliographies are appended—colloids and surface behaviour, computors, mathematics, statistics and automation, heat transfer, mass transfer, thermodynamics, fluid dynamics, chemisorption and surface catalysis, molecular transport properties of fluids, and diffusion and oxidation of solid metals.

W.K.R.

Eleventh Annual Unit Operations Review

Ind. Eng. Chem., **49**, 457–537 (March 1957, Part II)

Short reviews with comprehensive bibliographies (mainly 1955–1956), of the following subjects—absorption and humidification, adsorption, crystallisation, drying, evaporation, filtration, flotation, flow of fluids, high-temperature distillation, ion exchange, liquid extraction, materials handling, mixing and size reduction.

W.K.R.

PATENTS

Heat-exchange Apparatus especially suitable for use with Dye Liquors

Bradford Dyers' Assocn. *BP* 771,686

The liquid to be heated flows through a coil embedded in a substantial mass of a material of high thermal conductivity and high specific heat, e.g. aluminium or graphite. This material is heated to the desired temperature by passing a hot fluid (heated outside the apparatus) through another coil embedded in the mass, the speed of this fluid being regulated so that the desired temperature is maintained. The speed of the liquid being heated can be varied, within limits imposed by the characteristics of the mass, without causing substantial variations in the temperature at which it emerges from the apparatus.

C.O.C.

Continuous Coating of Filaments, Wire or Thin Strips

Plasti-Clad Metal Products *BP* 769,705

Apparatus which continuously coats filaments, etc. with a coating of uniform thickness. C.O.C.

Machine for Wet Processing Cloth in Open Width

J. Dungler *BP* 771,629

The machine consists essentially of a J-box the curved part of which is perforated and is in the processing liquor. The cloth is fed into the top of the box in superimposed folds which are subjected to vibration to produce periodic displacement of the folds relatively to one another.

C.O.C.

Web Guiding Apparatus

J. D. Robertson *BP* 770,926

A device to carry the web bodily back into its proper path and so avoid the delay in correction that occurs when the web gradually crawls back into its proper path.

C.O.C.

Continuous Impregnation of Cloth in Open Width

J. Dungler *BP* 770,130

The cloth is passed through a vat filled with liquid. In the vat there are space limiting members, e.g. endless belts placed close to the path of the cloth, these members moving parallel to the cloth and in either the same or the opposite direction. They do not come into contact with the cloth. Preferably the speed of these members is greater than that of the cloth so as to effect movement of the liquid. In addition their surface may be rough or they may be ribbed so as to increase movement of the liquid.

C.O.C.

Controlling the Tension in Cloth, Paper, etc. during Processing

Research Corpn. *BP* 770,969

Automatic Adjustment of the Speed of Squeeze Rollers to the Tension in the Cloth

Comerio Ercole S.p.A. *BP* 770,250

Milling Machine

K. Göbel *BP* 770,349

Drying Cloth or Paper

B. F. H. Mellbin *BP* 768,878

The drying air is made active twice in each cycle of its circulation. C.O.C.

Automatically Controlling the Temperature of Drying Cylinders

Thomas Holt *BP* 771,442

Discharge of Static Electricity from Textiles and other Dielectric Materials

Institut Textile de France *BP* 769,769

Modification of *BP* 769,055 (J.S.D.C., **73**, 270 (June 1957))

A stream of gas is used which has been in contact with any substance emitting electric charges, e.g. with a pointed conical electrode maintained at a constant potential.

C.O.C.

Continuous Shrinking of Felt or Woollen or Worsted Fabrics

R. D. L. Frederick *BP* 770,670

Shrinking Knitted Fabric

S. G. Andersonn *BP* 771,196

Modification of *BP* 747,981 (J.S.D.C., **72**, 403 (1956)) better results being obtained if the helical springs are heated electrically.

BP 769,853

Modification of *BP* 747,981 (J.S.D.C., **72**, 403 (1956))

An arrangement is described which causes the springs to contract while they are still bent over the roller.

C.O.C.

Indicator or Stop Device for Use in Conjunction with Feeding Means for Tacky Webs

Firestone Tyre & Rubber Co. *BP* 771,187

A device for sensing the end of a web of tacky material, e.g. coated fabric, which works in conjunction with the feeding means so that warning is given and/or the drive to the feed is automatically stopped. This avoids the need to re-thread the machine when, e.g. a roll of stock material is exhausted. C.O.C.

III—CHEMICALS; AUXILIARY PRODUCTS; FINISHING MATERIALS

Soap and Detergent Pilot Plant

R. F. Heald

Ind. Eng. Chem., **49**, 338–346 (March 1957, Part I)

Catalytic Decomposition of Nitrous Acid

M. A. Azim and S. D. Saraf

J. Indian Chem. Soc., **33**, 763–764 (Oct. 1956)

The decomposition of nitrous acid has been shown to be retarded by phthalic anhydride, potassium oxalate, molybdic acid, and liquid paraffin and accelerated by oxidising agents such as ammonium persulphate, by means of colorimetric methods using Griess–Ilosova's reagent (sulphanilic acid–α-naphthylamine). Salts such as sodium sulphate and potassium nitrate have no catalytic effect.

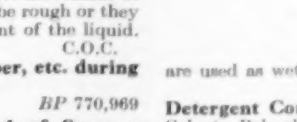
C.H.R.

PATENTS

Amphoteric Surface-active Agents

Rohm & Haas Co. *BP* 772,223

2-Hydrocarbon-substituted iminazoline-1-propionic acids and their salts, e.g.—



are used as wetting, emulsifying and detergent agents.

C.O.C.

Detergent Compositions

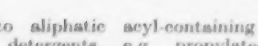
Colgate–Palmolive Co. *USP* 2,733,213–4

Addition of higher aliphatic acid amide type compounds, e.g. lauramide or stearamide, and tri-polyphosphates, e.g.

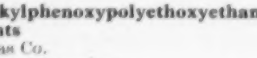
$Na_3P_3O_{10}$, to aliphatic acyl-containing sulphate and sulphonate detergents, e.g. propylated naphthalene sulphonates, synergistically improves their detersive power or foaming properties. C.O.C.

Ethers of Alkylphenoxypolyethoxyethanols—Surface-active Agents
Rohm & Haas Co. *BP* 770,073

Compounds of formula—



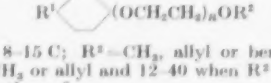
(R = Alk of 8–15 C; R^2 = CH_3, allyl or benzyl; n = 8–20 when R^2 = CH_3 or allyl and 12–40 when R^2 = benzyl), e.g. the benzyl ether of



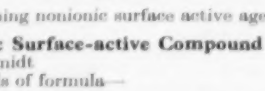
are low-foaming nonionic surface active agents. C.O.C.

Amphoteric Surface-active Compound
Th. Goldschmidt *BP* 771,635

Compounds of formula—



(x = 1–3; y = 0–3; $x + y < 6$; R^1 = Alk or alkaryl of 8–18 C; A = $-NR^3-$, $-NR^3\cdot(C_2H_4\cdot NH-)_z$ or $-NR^3\cdot(C_2H_4\cdot NH\cdot)_z$ (z = 1–3; R^3 = H or Alk of 8–18 C); R^2 = Alk, Hal, carboxy or



e.g. *o*- and *p*-octylaminomethylphenol and 2:2-bis-(*p*-hydroxy-*mm*-di-(dodecyldiethyleneaminomethyl)-phenyl)-propane, are surface-active agents having high germicidal properties. C.O.C.

Non-ionic Non-foaming Surface-active Agents
Air Reduction Co. *BP* 771,626

Symmetrical tertiary acetylenic glycols have remarkable wetting properties and very low foaming properties. The longer the main chain and the heavier the glycol molecule the greater the wetting action. Suitable compounds include 4:7-dimethyl-5-decyne-4:7-diol, 2:4:7:9-tetramethyl-5-decyne-4:7-diol, 5:8-dimethyl-6-duodecyne-5:8-diol, 3:6-dimethyl-4-octyne-3:6-diol and 2:5-diphenyl-3-hexyne-2:5-diol. C.O.C.

Size for Nylon
Atlas Powder Co. *BP* 770,223

Polyacrylic acid plasticised with a quaternary ammonium salt containing an aliphatic hydrocarbon radical of 10–20 C attached to the cation N atom, e.g. *N*-cetyl-*N*-ethyl morpholinium ethosulphate, is an excellent size for nylon warps. It is readily removed by scouring with non-ionic detergents. C.O.C.

Hair-waving Lotion
Van Ameringen-Haebler *BP* 771,627

The essential ingredient is the product obtained by treating either 2-amino-1-butanol or 2-amino-2-methyl-1-propanol with carbon disulphide and monochloroacetic acid. C.O.C.

Bactericidal and Fungicidal Compositions
American Sugar Refining Corpn. *BP* 770,966

The precipitate obtained by adding caustic alkali and an aqueous solution of a heavy metal salt, e.g. Cu, Cr, Fe, Co and Ni, to an aqueous solution of a hydrophilic colloid, e.g. dextran, with constant stirring, and finally adding a solution of a quaternary ammonium salt, e.g. cetyl trimethyl ammonium bromide, is a highly efficient rotproofing agent. It is insoluble in water and organic solvents but soluble in aqueous ammonia and some amines and amino alcohols, e.g. triethanolamine. Such solutions can be used for rotproofing textiles, etc. Alternatively the textiles, paper, leather, etc. can be impregnated with the hydrated heavy metal, oxide-hydrophilic colloid complex and then treated with a quaternary ammonium salt so as to form the agent *in situ*. C.O.C.

Textile and Dyeing Assistants
BASF *BP* 770,460

Caprolactams containing no substituents on nitrogen, e.g. C-methylcaprolactams, are excellent for increasing the speed of solution of mercerising and wetting agents and coupling components. Mixed with disperse dyes they considerably improve the readiness with which the dye is dispersed in water. They also improve the levelling and penetrating powers of sulphur dyes. Added to printing pastes they improve the uniformity of the prints and the through-printing. C.O.C.

Antistatic Agents
Calico Printers' Assocn. *BP* 770,766

The products obtained by treating 1 mol. of an aliphatic polymeric polyhydric alcohol with 1–2 mol. of an unsaturated aliphatic dibasic acid, preferably in an inert atmosphere or in presence of an antioxidant, so as to form a polyester of chain length 2·5–8·0 units as measured by the acid value, have the electrolytic properties of a hygroscopic substance and so can be used as an antistatic agent. It is applied from aqueous or organic solvent solution and is insolubilised on the fibre either by heating in air or by oxidation, if desired, in presence of a catalyst. The resulting antistatic finish is resistant to washing and dry-cleaning. C.O.C.

Solvent for Acrylonitrile Polymers
Vereinigte Glanzstoff-Fabriken *BP* 771,815

An aqueous solution of the complex $ZnCl_2.2NH_4Cl$ is a good solvent for polymers or copolymers of acrylonitrile. C.O.C.

Solvent for Acrylonitrile Polymers
BrC *BP* 771,810

The product, whose constitution is unknown, obtained by heating *NN*-dimethylformamide with cyanogen bromide and isolating the fraction of approx. b.p. 96°c. under 14 mm. Hg pressure, dissolves polymers or copolymers of acrylonitrile at 30°c. The solutions can be cooled to 20°c. before gelling. C.O.C.

Resins as Tanning Agents
Boehme Fettchemie *BP* 772,440

The resins obtained by condensing dicyandiamide with formaldehyde or other carbonyl compound in presence of a sulphite are good tanning agents. C.O.C.

IV—RAW MATERIALS; INTERMEDIATES; COLOURING MATTERS

C. B. Mansfield *versus* F. Crace Calvert—A Forgotten Controversy in the Coal-tar Industry
E. R. Ward
Chem. and Ind., 159–160 (9 Feb. 1957)

A brief account of the attempt by Crace Calvert in 1854 to claim credit for developing processes for obtaining benzene, etc. from coal-tar C.J.W.H.

James Miller, Son & Co. Ltd.
A. Kent
Chem. and Ind., 300–301 (9 March 1957)

This is stated to be the Glasgow firm which supplied benzene to Perkin & Sons. C.J.W.H.

Intensities of the Forbidden Bands of Benzene
(Mrs) J. K. Thompson and A. D. E. Pullin
J.C.S., 1658–1665 (April 1957)

The peak densities of the 1174 cm.$^{-1}$ forbidden band and the peak densities and half-intensity widths of the 851 cm.$^{-1}$ forbidden band of benzene are reported for its soln. in a variety of solvents; the former increase smoothly and rapidly with increase of refractive index of solvent, the peak density for the CS_2 soln. being anomalously large. It is suggested that the large half-intensity widths of the forbidden bands are due to the fact that the transition moment for transitions giving rise to absorption at the wings of the bands is larger than that for transitions giving rise to absorption at frequencies near the band max. A similar trend was found for the peak densities of the allowed 1033 cm.$^{-1}$ band, and could be explained on the basis of decreasing half-intensity width of this band with increasing solvent refractive index. H.H.H.

Alkyl Sulphonates in Alkylations of Aromatic Systems
A. Streitwieser and W. D. Schaeffer
Chem. and Ind., 461 (13 April 1957)

Alkylation in the Aromatic Nucleus by Esters of Sulphonic Acids
M. S. Grant, W. J. Hickinbottom, N. W. Rogers, and N. G. Rule
Chem. and Ind., 461–462 (13 April 1957)

Action of Thionyl Chloride on Naphthols
V. G. Kulkami and G. V. Jadhov
J. Indian Chem. Soc., **33**, 738–740 (Oct. 1956)

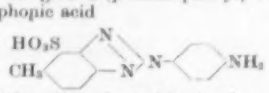
Thionyl chloride reacts with α-naphthol in the presence of copper powder with ether as solvent to give 4:4′-dichloro-1:1′-dinaphthyl sulphide and the corresponding 4:4′-dihydroxy compound. With β-naphthol only 2:2′-dihydroxy-1:1′-dinaphthyl sulphide was isolated. C.H.R.

Kinetic Form of the Benzidine and Semidine Rearrangements
C. A. Burton, C. K. Ingold, and M. M. Mhala
J.C.S., 1906–1913 (April 1957)

The rate of rearrangement of hydrazobenzene to benzidine and diphenyline in presence of perchloric acid in 60% aq. dioxan is correlated with Hammett acidity functions rather than with acid conc., the dependence being quadratic at low acidities. The rearrangement is then found to take place in a second conjugate acid, formed wholly by specific hydrogen-ion catalysis, i.e. by two successive pre-equilibria which desolvate the two successively adding protons. This conclusion is confirmed by the unprecedentedly large acceleration when the water in the solvent is replaced by deuterium oxide. The rearrangement of 4:4′-dimethylhydrazobenzene to the *o*-semidine shows a similar quadratic dependence on acid, the two rearrangements having thus an identical kinetic form. These results delimit permissible theories of the two rearrangement mechanisms. H.H.H.

Aromatic Diazo and Azo Compounds. XXI—New Yellow Dyes related to Chloramine Yellow
J. Poskocil and Z. J. Allen
Chem. Listy, **50**, 1789–1797 (1956): *Chem. Abs.*, **51**, 4360 (25 March 1957)

Analogues of Chloramine Yellow containing benzimidazole, benztriazole and naphthothiazole rings were prepared. Thus, 4-amino-3-nitrotoluene was diazotised and coupled with aniline-*o*-methanesulphonic acid, followed by hydrolysis, reduction, ring closure and sulphonation to give 2-(*p*-aminophenyl)-5-methylbenzotriazole-4-sulphonic acid



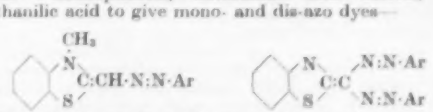
Treatment with sodium hypochlorite then gave the azo dye. E.S.

Molarity Quotients of some Metal Complexes of Pyrazolone Dyes
F. A. Snavely, W. C. Fernelius, and B. P. Block
J. Amer. Chem. Soc., **79**, 1028–1030 (5 March 1957)

Potentiometric measurement of the relative stabilities of the metal derivatives of simple azo pyrazolone compounds in 75 volume % dioxane shows that the order of decreasing stability of the metal derivatives, Cu > Ni > Co > Zn, agrees with that of other bidentate groups. C.O.C.

Azo Colorants derived from 1:2-Dimethylbenzothiazolium Salts
M. T. Le Bris
Ann. Chim. (*Paris*), [xiii], **1**, 328–379 (1956): *Chem. Abs.*, **51**, 2740 (25 Feb. 1957)

2:3-Dimethylbenzothiazolium methosulphate in 25% aq. soln. below 10°c. reacted with diazonium salts derived from *o*-aminophenols, anthranilic acid derivs., and orthanilic acid to give mono- and dis-azo dyes—



Under slightly acid conditions reaction is slow and gives mainly monoazo dyes, whereas below 0°c. in strongly alkaline soln. disazo compounds were formed although in low yield. The monoazo compounds could also be coupled with a second diazo compound to give disazo dyes. E.S.

Utilisation of 1:4-Naphthaquinone—Synthesis of 1:4-Dialkoxynaphthalenes, their Amino Derivatives, and Derived Azo Dyes
A. Inoue, K. Nakano, N. Kuroki, K. Konishi, and T. Kitao
J. Soc. Org. Synthet. Chem. Japan, **14**, 513–516, 622–625, and 676–681 (1956): *Chem. Abs.*, **51**, 4713 (25 March 1957)

1:4-Naphthaquinone in methanol or ethanol saturated with HCl gas was boiled with Sn or $SnCl_2$ to give the corresponding 1:4-dialkoxynaphthalene. Nitration and reduction with Raney nickel gave the 2-amino compounds which, diazotised and coupled with members of the Naphtol AS series gave dark purple to purplish black azoic dyes, or condensed with 3:2-hydroxynaphthoic acid gave azoic coupling components. The preparation of 2-amino-3-chloro-1:4-dialkoxynaphthalenes is also described. 1:4-Dihydroxynaphthalene monomethyl ether coupled with diazotised aniline, *p*-nitroaniline, etc. to give red disperse dyes. E.S.

Colour Couplers for Subtraction Colour Photography. VI—Synthesis of Benzylacetanilide Derivatives containing the Sulphonamido Group
N. Kunimine
J. Pharm. Soc. Japan, **76**, 910–911 (1956): *Chem. Abs.*, **51**, 3563 (10 March 1957)

Dye Formation in Colour Photography
W. A. Schmidt
Science et Ind. phot., **27**, 488–489 (1956): *Chem. Abs.*, **51**, 2433 (25 Feb. 1957)

Review of methods of oxidative dye coupling development. Only aromatic primary amino type developers have been successfully used. Hydrazine derivatives are unsuitable as photographic developers. C.O.C.

Hyaman Dyes. New Sulphur Dyes
H. Hiyama and O. Manabe
Kagaku to Kōgyō (Osaka), **30**, 441–442 (1956): *Chem. Abs.*, **51**, 5425 (10 April 1957)

"Hyaman" (from the authors' names) dyes were readily synthesised (oxidation rather slow unless done in vapour phase) with about 80% yields by linking a conjugated chromophore, R, with an SX group through a resonant insulator, B, i.e. R-B-SX. In dyeing trials (using 2·5% soln. made by rendering the water-insoluble dyes soluble with NaOH or an alkaline reducing agent and then bringing to pH 8–11 with $NH_4H_2PO_4$ and dyeing at 70–100°c.) the azo sulphur dyes (Orange G and R, Brilliant Orange G, Red, Brilliant Red, Blue, Golden Yellow, Scarlet and Garnet) and anthraquinone sulphur dyes (dull violet and violet) yielded dyes of more than average fastness to light and washing, but were surpassed in these respects by the phthalocyanine sulphur dyes (green, blue-green, pale blue and green-blue). C.O.C.

Oxidation of the leuco Base of Malachite Green (C.I. Basic Green 4) with Sodium Dichromate in presence of Oxalic Acid
V. Hanousek and M. Matrka
Chem. Listy, **50**, 1969–1973 (1956): *Chem. Abs.*, **51**, 5014 (10 April 1957)

The relationship between the yield of Malachite Green (C.I. Basic Green 4) and the rate of addition of the oxidant when treating 4:4′-bis(dimethylamino)triphenylmethane with $Na_2Cr_2O_7$ or $Ce(SO_4)_2$ in dil. H_2SO_4 in presence of oxalic acid was studied. Very quick addition of oxidant results in 96–98% yields, whereas slow or interrupted addition reduces them to 18–35%. This is because the dye is converted to a hydrated form, apparently the cation of the carbinol base $[(p\text{-}(CH_3)_2NHC_6H_4)_2C(OH)C_6H_5]^+$ which is readily susceptible to oxidation and decomposition. Oxalic acid does not function as an inductor but possibly a transitory complex may be formed. C.O.C.

Triphenylmethane Dyes. I—Condensation of *N*-Methylcumidine with Formaldehyde, Michler's Ketone, and *o*-Chlorobenzaldehyde
J. Arient and J. Dvořák
Chem. Listy, **50**, 1974–1977 (1956): *Chem. Abs.*, **51**, 4001 (10 March 1957)

4:4′-Bis(methylamino)-3:3′-diisopropyl-2″-chlorotriphenylmethane (I) was obtained in 30·2 g. yield by stirring

into *N*-methyl-*o*-cumidine (II) (22·4 g.), H_2SO_4 (60° Bé. diluted with 4·5 ml. water) (9·3) and then *o*-chlorobenzaldehyde (10·7), the mixture treated under CO_2 for 24 hr. at 100°c., poured into water, made alkaline with ammonia, the precipitate dissolved in HCl, decolorised with C and recrystallised from alcohol. To a solution of I (4·2) in dil. HCl, ice was added and freshly prepared 20% PbO_2 paste containing 2·39 g. PbO_2. After removing Pb ions with Na_2CO_3 and Na_2SO_4, and salting out with NaCl (35), 4:4′-bis(methylamino)-3:3′-di*iso*propyl-2″-chlorotriphenylcarbinol (4·4) was obtained. It dyes wool a brilliant pure blue. Addition of $POCl_3$ (8) to Michler's ketone (13·5) in $CHCl_3$ (40 ml.), heating at 60–65°c. for 30 min., adding at 55°c. II (7·46), heating for 12 hr. at 60°c., gave after decolorising with C and precipitation 4:4′-bis(dimethylamino-4″-methylamino-3″-*iso*propyltriphenylcarbinol (19·5) which dyes wool slightly redder than C.I. Basic Violet 5. The absorption spectrum of III shows a hypsochromic shift when compared with those of C.I. Basic Violet 5 and C.I. Basic Blue 5. C.O.C.

Acridine Orange (C.I. Basic Orange 14) and Primuline (C.I. Direct Yellow 59) as Vital Fluorochromes

J. Smiles and A. E. R. Taylor; M. W. H. Bishop and J. Smiles

Nature, **179**, 306–308 (9 Feb. 1957)

Substitution Reactions of 2-Acetamidothiazoles—I

M. K. Rout

J. Indian Chem. Soc., **33**, 741–743 (Oct. 1956)

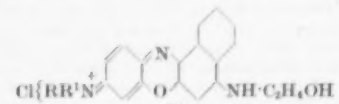
Reaction of 2-acetylamino-4-phenyl-, 4-4′-methoxyphenyl-, 4-2′-thienyl, and 4-2′-naphthyl-thiazoles with mercuric chloride gave the corresponding 5-chloromercuric derivatives. These on treating with bromine, iodine, and thiocyanogen gave the corresponding 5-bromo, 5-iodo, and 5-thiocyano compounds. C.H.R.

Synthesis of Substituted Amino-phenoxazines

A. B. Sen and R. C. Sharma

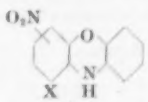
J. Indian Chem. Soc., **33**, 671–678 (Sept. 1956)

5 - β - Hydroxyethylamino - 9 - dialkylamino benzo - phenoxazonium chlorides (I) have been prepared by condensing 1-*N*-β-hydroxyethylaminonaphthalene with 5-alkyl- and 5-dialkyl-amino-2-nitrosophenol hydrochlorides. 2-Aminophenol has been condensed with 2-chloro-3:5-dinitrodiphenyl-4-chloro-3:5-dinitrodiphenyl, 4-chloro-3:5:4′-trinitrodiphenyl, and 4-chloro-3:5-dinitro 1-*tert.*-butylbenzene to give the corresponding nitrophenoxazine (II).



(I)

(R = H, $R^1 = C_2H_5$; or $R = R^1 = CH_3$, C_3H_7, C_4H_9, C_5H_{11}; or C_6H_{12})



(II)

(X = C_6H_5, *p*-NO_2·C_6H_4, or $(CH_3)_3C$).

C.H.R.

Ultraviolet Absorption Spectra of some Condensed Thiophen Derivatives

W. Carruthers and J. R. Crowder

J.C.S., 1932–1933 (April 1957)

Ultraviolet absorption spectra are recorded for 4:5- and 6:7-benzothionaphthen, thiophanthren, thiophanthren dioxide, and 2-methyl-5:6- and 2-methyl-7:8-benzothiophanthren, which support the conclusion of Badger and Christie (*J.C.S.*, 3438 (1956)) that there is a fundamental similarity between the spectra of the heterocyclic cpd. and those of the related benzenoid hydrocarbons. H.H.H.

Polynuclear Aromatic Hydrocarbons. III—New Route to Chrysene Derivatives

V. S. Gaind, M. L. Vashisht, and S. M. Mukherji

J. Indian Chem. Soc., **33**, 697–702 (Oct. 1956)

Anthraquinone and Anthrone Series. XX—Simple Synthesis of Lucidin and Munjistin

N. R. Ayyangar and K. Venkataraman

J. Sci. Ind. Research (India), **15B**, 359–362 (1956); *Chem. Abs.*, **51**, 5027 (10 April 1957)

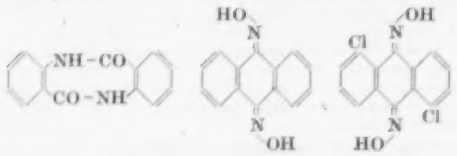
Xanthopurpurin (5 g.) was heated with 5% NaOH (50 ml.) and 35% HCHO (3 ml.) for 12 hr. at 20–25°c., the sodium salt filtered off and decomposed with dil. HCl to yield lucidin (1:3-dihydroxy-2-hydroxymethylanthraquinone) (4·6 g.). This (1 g.) treated with water (20 ml.) containing NaOH (1·36 g.) and Ag_2O (from 1·36 g. $AgNO_3$) at 75°c., filtering and acidifying yielded munjistin (1:3-dihydroxanthraquinone-2-carboxylic acid) (0·45 g.). C.O.C.

Beckmann Rearrangement of the Dioximes of Anthraquinone and 1:5-Dichloroanthraquinone

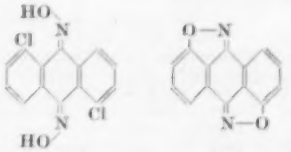
H. N. Rydon, N. H. P. Smith, and D. Williams

J.C.S., 1900–1905 (April 1957)

The Beckmann rearrangement of anthraquinone dioxime with polyphosphoric acid gives dianthranilide (I) in good yield; the dioxime, therefore, has the *anti*-configuration (II) when obtained by the pyridine procedure. 1:5-Dichloroanthraquinone yields a mixture of two dioximes which are shown, on the basis of the products afforded by the Beckmann rearrangement, to be the *trans-trans*- (III) and *cis-trans*- (IV) cpd. Both oximes are cyclised by alkali, at approx. equal rates, to be bis-*iso*-oxazole (V), and it is shown that this cyclisation is accompanied by stereochemical inversion; the general validity of such cyclisations for the assignment of oxime configurations is questioned.



(I) (II) (III)



(IV) (V)

H.H.H.

Vacuum Deposition of Aminoanthraquinone Compounds on Quartz

G. S. Egerton and A. G. Roach

Nature, **179**, 491–492 (2 March 1957)

Absorption spectra of 2-aminoanthraquinone (I) deposited on quartz by a vacuum technique, and dyed on cellulose acetate film and nylon film, are reproduced and discussed. The spectra of I on quartz and on cellulose acetate are closely similar, but on nylon there is a bathochromic shift in the only two absorption peaks that could be measured. More complex compounds, e.g. 1:4:5-triaminoanthraquinone, give satisfactory transparent films over a wider range of deposition conditions than do 1- and 2-aminoanthraquinone. Whilst 1:4-di-, 1:4:5-tri-, and 1:4:5:8-tetra-aminoanthraquinone show twin absorption peaks somewhere in the region between 5500 and 6600A. when dyed on either cellulose acetate or nylon film, there is no evidence of such peaks when they are deposited on quartz; there is, instead, a general absorption band somewhere between 5100 and 6500A. All three exhibit, on quartz, a very marked absorption max. at ca. 2500A. J.W.D.

Intermediates and Dyes. V—Derivatives of Thiophanthrene-4:9-quinone

A. T. Peters and D. Walker

J.C.S., 1525–1533 (April 1957)

The title substances are examined with special reference to those cpd. with easily replaceable chlorine atoms. 3:6-Dichloro-2:2′-thenoylbenzoic acid, best prepared from 3:6-dichlorophthalic anhydride by the Grignard reaction, affords the yellow 5:8-dichlorothiophanthrene-4:9-quinone,

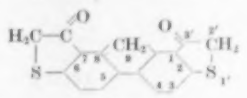
converted into 8-chloro-5-amino- and 5:8-diamino-thiophanthrene-4:9-quinone, which dye cellulose acetate rayon and nylon bluish-red and bluish-violet shades respectively, bluer than the shades given by the anthraquinone analogues. 3:6-Dichloro-2-(2:5-dimethyl-3-thenoyl) benzoic acid, prepared by the Friedel-Crafts reaction, is cyclised to the yellow 5:8-dichloro-1:3-dimethyl-β-thiophanthrene-4:9-quinone, and converted into dyes which are redder than the anthraquinone analogues. Compared with the anthraquinone analogues, there is a loss of tinctorial power when a benzene- is replaced by a thiophen-ring. Friedel-Crafts reactions are examined between 3:6-dichlorophthalic anhydride and 2- or 3-methylthiophen; in the latter case the initial product is 3:6-dichloro-2-(3-methyl-2-thenoyl) benzoic acid, with only 5% of the 4-methyl isomer. H.H.H.

Indigoid Dyes. XIX—Thioindigoid Dyes from Fluorene-2:7-disulphonic Acid

P. C. Dutta and D. Mandal

J. Indian Chem. Soc., **33**, 721–723 (Oct. 1956)

Fluorene-2:7-disulphonic acid has been converted via the disulphonyl chloride, dimercapto- and bisthioglycollic acid to 2:1:7:8-fluoreno-bis-3′-hydroxy-1′-thiophen (I). This has been condensed with α-ketones such as isatin, acenaphthenequinone, phenanthraquinone, aceanthraquinone, and some of their nitro and halogeno derivatives and with glyoxal to give thioindigoid dyes which have insoluble or sparingly soluble leuco compounds and which are deeper in colour than those obtained from fluorene-2-sulphonic acid. Oxidation of the thiophen compound with potassium ferricyanide gives a very poor yield of the bis-indigo.



(I)

C.H.R.

Spectral Maxima of Stereoisomeric Polyenes

L. Zechmeister and E. F. Magoon

Chem. and Ind., 431–432 (6 April 1957)

The authors defend a previous generalisation (*Experientia*, **10**, 1 (1955)) against the criticism of Holmes, Jones, and Whiting (*Chem. and Ind.*, 928 (1956)). Their statement, that an all-*trans* cpd. shows a longer wavelength max. than any of its *cis* isomers, is said to relate to carotenoids and diphenylpolyenes only. J.W.D.

Absorption and Fluorescence Spectra of Flavones

S. K. K. Jatkar and B. N. Mattoo

J. Indian Chem. Soc., **33**, 623–629 (Sept. 1956)

Substitution of a methoxy or benzyloxy group in the 4′-position of flavone has a bathochromic effect on the absorption spectra which is slightly intensified by a methyl group in the 6- or 8-positions. A benzoyl group in the 6-position alters the spectra completely. In the fluorescence spectra replacement of the 4′-methoxy group by 4′-benzyloxy slightly increases the efficiency but in the latter compound a methyl group in the 6-position or a methoxy group in the 3′- or 7:3′-positions increases the efficiency considerably. A 6-benzoyl group in 4′-methoxy flavone shifts the fluorescence maximum to rest with a marked fall in efficiency. A solvent effect has been observed in that the quantum efficiency increases when the water content of aqueous ethanol is increased. C.H.R.

Absorption of Fluorescence Spectra of Flavonols

S. K. K. Jatkar and B. N. Mattoo

J. Indian Chem. Soc., **33**, 641–646 (Sept. 1956)

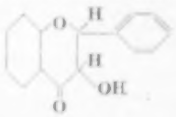
Flavonols show an additional absorption band due to keto–enol tautomerisation and thus are pH-dependent, when the derived acetoxy compounds behave as flavones. The bathochromic effect of introduction of methoxy and benzyloxy groups in the 4′-position and of methyl in the 6- and 7-positions and benzoyl in the 6-position are discussed. The fluorescence spectrum of flavonols has two visible bands, a blue (weak) and a green (strong). Inclusion of a methoxy or benzyloxy group in the 4′-position increases the efficiency, whilst a 6-benzoyl group greatly reduces it. Acetylation of the hydroxy group reverts the fluorescence spectrum to that of the flavone with considerable decrease in efficiency. C.H.R.

Absorption Spectra of Dihydroflavonols

S. K. K. Jatkar and B. N. Mattoo

J. Indian Chem. Soc., **33**, 651–652 (Sept. 1956)

The absorption spectra of dihydroflavonol (I) and its 4′-methoxy derivative is similar to that of flavonone. Introduction of a 6-methyl group has a bathochromic effect. These products are non-fluorescent.



C.H.R.

Absorption and Fluorescence Spectra of Benzylidene-coumaranones

S. K. K. Jatkar and B. N. Mattoo

J. Indian Chem. Soc., **33**, 647–650 (Sept. 1956)

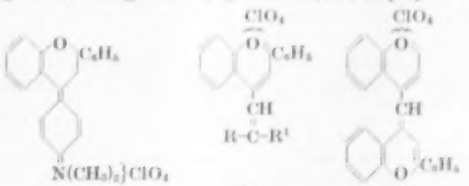
Owing to increased resonance, the absorption spectrum of 4-methoxybenzylidene coumaranone (I) extends into the visible range max. (402 mμ). Introduction of a methyl group in the 5- and 7-positions has a slightly bathochromic effect. Whereas a 6-methyl or 3′-methoxy or 4′-benzyloxy group has little effect on the absorption at the longest waveband, it alters the nature of the spectrum in the high frequency. These compounds show a brilliant green fluorescence in the solid state but only a feeble blue in solution. C.H.R.

Reactions of Flavylium Salts with Dimethylaniline and Malonic Acid

M. Blackburn, G. B. Sankey, A. Robertson, and W. B. Whalley

J.C.S., 1573–1576 (April 1957)

It is found that the nature and scope of the condensation of dimethylaniline, diarylethylenes, and malonic acid with flavylium salts (e.g. perchlorates and chlorides) (cf. Wizinger, *Chimia* (Switz.), **6**, 243 (1952)), to give products of types (I), (II), and (III), is an oxidative coupling, depending on the supply of atmospheric oxygen. The reaction does not take place in nitrogen, and the condensation is equally productive when flavylium salts containing non-oxidising anions (e.g. chloride) are employed.



(I) (II) (III)

H.H.H.

Structure and Reactions of Gossypol. IV—Synthesis of Desapogossypol Hexamethyl Ether

D. A. Shirley and W. L. Dean

J. Amer. Chem. Soc., **79**, 1205–1207 (5 March 1957)

1:1′:6:6′:7:7′-Hexamethoxy-3:3′-dimethyl-2:2′-dinaphthyl has been synthesised and shown to be identical with desapogossypol hexamethyl ether, a degradation product of gossypol. C.O.C.

Pigment of Red Cabbage (*Brassica oleracea*)

I. Chmielewska, I. Kakowska, and B. Lipiński

Bull. Acad. polon. sci., Classe III, **3**, 527–530 (1955); *Chem. Abs.*, **51**, 5061 (10 April 1957)

The pigment, rubrobrassicine chloride, gives a trimethyl derivative with CH_2N_2. Alkaline hydrolysis of the pigment yields rubrobrassine dimethylether which with CH_2N_2 gives the above trimethyl derivative. Methanolysis yields an aglucon containing OCH_3, rubrobrassidine. As 2 mol. glucose are present and there are three substituents for the OH groups, the sugar must be a biose. A structure for the pigment is postulated. C.O.C.

Fungal Colouring Matters. Structures of Rugulosin, Rubroskyrin, and Flavoskyrin

S. Shibata, T. Murakami, and I. Kitagawa

Proc. Japan Acad., **32**, 356–360 (1956); *Chem. Abs.*, **51**, 2699 (25 Feb. 1957)

Rugulosin, a yellow colouring matter produced by *Penicillium rugulosum*, *Endothia parasitica* and *E. fluens*,

is shown to be bis-(2:4:5-trihydroxy)-7-methyl-2-(*H*)-1-anthraquinone. Rubroskyrin, a red colouring matter produced by *P. islandicum*, seems to be bis-(2:5:8-trihydroxy-4-oxo-7-methyl-1(*H*), 2(*H*), 3(*H*)-1-anthraquinone and flavoskyrin, a yellow colouring matter produced by *P. islandicum*, 2:4:5-trihydroxy-7-methyl-2-(*H*)-anthraquinone. C.O.C.

Isolation of Melanin Granules
A. Filson and J. Hope

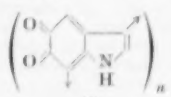
Nature, **179**, 211 (26 Jan. 1957)

Melanin-containing protein is refluxed with 60% (wt./vol.) hydrazine–absolute alcohol soln. for 2 hr., using a liquor ratio of 50 : 1. Undispersed matter is filtered out on a coarse paper, the granules passing through. The suspension is centrifuged for 2 hr. at 2,000**g**, the supernatant liquor is decanted off and the residual granules are washed three times with dist. water. The method is relatively rapid, and the melanin is chemically and morphologically unaffected. There is an electron micrograph. J.W.D.

Oxidation of some Synthetic Melanins
F. Binns and G. A. Swan

Chem. and Ind., 396–397 (30 March 1957)

Pyrrole-2:3-dicarboxylic and -2:3:5-tricarboxylic acids are shown by chromatographic analysis to be present in the products obtained by the action of alkaline hydrogen peroxide on melanins derived not only from tyrosine and 3:4-dihydroxyphenylalanine, but also from 3:4-dihydroxyphenylethylamine and 5:6-dihydroxyindole. Tyrosine melanin differed somewhat from the other melanins studied, but as the amounts present of the above acids are very small, the weight which can be attached to their formation so far as providing an argument against the structure for melanin (I) proposed by Bu'Lock and Harley-Mason (*J.C.S.*, 703 (1951)) is uncertain (cf. Nicolaus *et al.*, *Gazz. chim. ital.*, **82**, 435 (1952); **83**, 239 (1953); **85**, 1397 (1955)).



(I)

H.H.H.

Graphitisation. I— Changes of Crystallinity, Diamagnetic Susceptibility, and Electrical Conductivity
H. Akamatu, H. Inokuchi, H. Takahashi, and Y. Matsunaga

Bull. Chem. Soc. Japan, **29**, 574–581 (July 1956)

At 3000°c. pitch cokes graphitise more readily than carbon blacks. Violanthrone and polyvinyl chloride are intermediate. Magnetic susceptibility increases with increasing size of plane molecules (L_a) to a limiting value of $6{\cdot}5 \times 10^{-6}$/g. (the value for natural graphite) when $L_a > 130$ A. Resistivity decreases to a constant value for each carbon when $L_a > 40$ A. A.J.

History, Manufacture, and Uses of Lithopone
J. G. Rigg

J. Oil & Col. Chem. Assocn., **39**, 809–831 (Nov. 1956)

Calcium Plumbate
N. J. Read

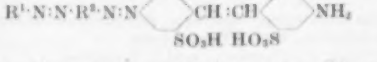
Corrosion Technol., **3**, 119–123 (1956); *Chem. Abs.*, **51**, 4019 (10 March 1957)

An account of trials made in sea water and outdoor weathering on the rust-inhibiting action of paints pigmented with calcium plumbate. C.O.C.

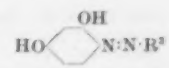
PATENTS

Brown, Metal(Copper)-complex Polyazo Stilbene Dyes for Leather
S *BP* 773,790

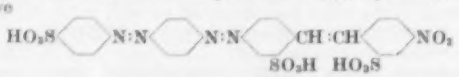
Aminodisazo compounds—



(R^1 = aryl of benzene or naphthalene series; R^2 = aryl of benzene, naphthalene or diphenyl series; common substituents may be present) are diazotised and coupled with 1 mol. of a monoazo compound (or its copper complex)



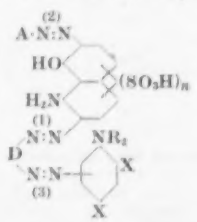
(R^3 = benzene series aryl residue containing, *ortho* to the azo group, a group capable of metal complex formation). The tetrakisazo compound so formed is made if necessary into its copper complex, or may be coupled with 1 mol. of diazobenzene before or after metallisation. The products are direct dyes and give well penetrated browns on leather, fast to buffing. Thus 4:4′-dinitrostilbene-2:2′-disulphonic acid is stirred with 4-aminonazobenzene-4′-sulphonic acid at 80°c. in presence of 3% aq. NaOH to give



Reduction with aq. Na_2S then gives the amino compound, which is diazotised and coupled with 1 mol. of the copper complex of the monoazo compound 2-aminophenol-4-sulphonic acid → resorcinol. The product dyes chrome suède leather bright reddish brown. E.S.

Black Trisazo Dyes for Leather
CFM *BP* 773,913

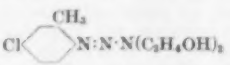
Tetrazotised diamines (D) are coupled under acid conditions with 1 mol. of a 1:8-aminonaphtholsulphonic acid, the product is coupled with 1 mol. of a diazo compound, and the second diazo group of D is then coupled with a 1:2- or 1:4-diamino or -aminohydroxy compound of the benzene series, to give trisazo dyes of the type



(D = residue of diamine containing one or two benzene nuclei; A = aryl of benzene or naphthalene series; one X = H, the other X = OH or NH_2; R = H, Alk, aralkyl, *cyclo*alkyl or phenyl; $n = 1$ or 2). They dye leather bluish black, and are less sensitive to acid and alkali than the similar dyes in which *m*-phenylenediamine or its substitution products are used as end components (*USP* 688,478). Thus tetrazotised benzidine is coupled with 1 mol. of H acid in presence of acetic acid, the product is coupled with 1 mol. of diazobenzene in presence of soda ash, and finally a soln. of 1 mol. of *o*-phenylenediamine is added. E.S.

Azoic Dyes on Nylon in Presence of Animal or Vegetable Fibres
FH *BP* 772,593

The diazoamino compounds made by condensing hydroxydialkylamines such as diethanolamine with diazo compounds from aromatic amines free of negative substituents such as NO_2, $C_6H_5{\cdot}SO_2$, COOH, or 2 Cl atoms have affinity for nylon, and readily regenerate the diazo compound under acid conditions. Hence by applying them to nylon-containing textiles along with suitable coupling compounds, azoic dyeings can be produced. Thus the diazoamino compound from diethanolamine and diazotised 5-chloro-2-aminotoluene



is mixed with an alkaline soln. of 3-hydroxy-2-naphtho-*p*-chloro-*o*-methylanilide and applied to a mixture of nylon with wool or viscose at 60°c. The diazoamino compound is absorbed mainly by the nylon, and the coupling component by both fibres present. Treatment in a cold bath of diazotised 5-chloro-2-aminotoluene develops the red azoic dye on the wool or viscose, and the colour on the nylon is then developed by treatment at 70–80°c. for 10 min. in a 0·5% soln. of H_2SO_4. E.S.

Anthraquinone Vat Dyes

Ciba *BP* 771,748

Olive-brown vat dyes of good fastness to light and chlorine but of unknown constitution are obtained by heating the product obtained when a 6:Bz-1-di(α-anthraquinonylamino)-benzanthrone is treated with an alkaline condensing agent, in a melt comprising $AlCl_3$ and SO_2. Thus $AlCl_3$ and NaCl (added to lower the m.p.) are heated at 140°C. A current of SO_2 is passed through the mixture and the temperature allowed to fall to 105°C. The product of the alkaline condensation of 6:Bz-1-di-(α-anthraquinonylamino)-benzanthrone as described in *BP* 337,741 (J.S.D.C., **47**, 86 (1931)) is added and the mixture heated 1 hr. at 105–10°C. The melt is poured on to ice and water, acidified with HCl, heated to 90°C. and filtered. E.T.

Anthraquinone Vat Dyes

BASF *BP* 771,347

Vat dyes of good fastness are produced by condensing 1 mol. of a 2:4-dihalogeno- or a 2:4:6-trihalogeno-quinazoline containing a sulphonamido- or trifluoromethyl group with 2 mol. of identical or different water-insoluble amino-anthraquinones. Thus, a mixture of 2:4-dichloro-6-sulphodimethylamide, 1-amino-5-benzoylamino-anthraquinone and nitrobenzene is heated 5 hr. at 160°C. After cooling the precipitated dye is filtered. An acid binding agent may be used. Also different amino-anthraquinones may be used in two stages to give mixed substituted quinazolines. E.T.

Anthraquinone Disperse Dyes

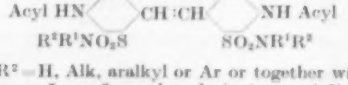
Ciba *BP* 770,570

Blue disperse dyes are produced by condensing in presence of ≤ 2 mol. of a tertiary amine (1 mol.) 1:5-dihydroxy-4:8-dinitro or 1:8-dihydroxy-4:5-dinitroanthraquinone or a mixture as produced by the method of *BP* 612,009 (J.S.D.C., **65**, 187 (1949)) with ≤ 2 mol. of a primary amine whose N is bound to a cyclic C atom and which contains no water solubilising group. The N atom of the tertiary amine is attached to 2 aliphatic C atoms and its presence in the reaction gives rise to different and better end products than those normally obtained. 1:8-Dihydroxy-4:5-dinitroanthraquinone is heated in tri-*iso*-propanolamine with 1-amino-4-chlorobenzene at 160°C. for 10 hr. The product is precipitated by the addition of CH_3OH, HCl and water, filtered, washed and dried. Reprecipitation from H_2SO_4 solution gives a blue dye in suitable form for dispersion. E.T.

Fluorescent Brightening Agents for use in Spinning Solutions or Melts

FBy *BP* 772,308

Compounds of formula—



(R^1 and R^2 = H, Alk, aralkyl or Ar or together with an *N* atom form a 5- or 6-membered ring), e.g. 4-4′-diacetylaminostilbene-2-2′-disulphomorpholide, added to spinning solutions or melts impart fluorescence in ultraviolet radiation to fibres produced from such solutions or melts. In addition dyeings on such fibres appear cleaner and deeper. The effects are very resistant to wet processing. Disulphonamides of diaminostilbene compounds of the above type obtained by treating diaminostilbenes with cyanuric chloride and then if necessary with ammonia or a primary or secondary amine, 4:5-diarylimidazolones-2 and 4:5-diarylimidazothiones-2 can be similarly used. C.O.C.

Water-soluble Phthalocyanines

ICI *BP* 770,784

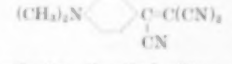
Modification of *BP* 587,636 (J.S.D.C., **63**, 304–305 (1947))

Phthalocyanine derivatives containing quaternary ammonium groups can be made by heating an alkyl or aralkyl ester with P-$(CH_2NR^1R^2)_n$ (P = subst. or unsubst. phthalocyanine; R^1 = subst. or unsubst. Alk, *cyclo*Alk, aralkyl or heterocyclic radical; R^2 = subst. or unsubst. Alk or R^1 and R^2 together with the N atom form a ring; $n > 1$). The phthalocyanine derivative containing the tertiary amino-group may be made by heating the appropriate chloro-methyl-phthalocyanine with a secondary amine in an inert solvent with an acid binding agent. Thus, trichloromethyl-Cu-phthalocyanine, N-methylbenzylamine, $CaCO_3$ and dioxan are heated at 90–95°C. Water and HCl are added to the cooled mixture to dissolve the tertiary base formed. After boiling and filtering the filtrate is made alkaline and the precipitated tertiary base filtered, washed alkali-free and dried. This product is then heated 2-5 hr. at 95–100°C. with $(CH_3)_2SO_4$, cooled to 20°C. and acetone added. The water-soluble methosulphate so formed is filtered off, washed with acetone and dried. E.T.

C-Tricyanovinyl Compounds as Dyes

DuP *BP* 767,423

Highly coloured compounds substantive to natural and synthetic fibres contain a $(CN)_2C{-}C(CN)$– group attached to a ring C atom of a cyclic or heterocyclic nucleus which also has an auxochrome substituent attached to a second ring C. They are prepared by oxidising the corresponding α,β,β-tricyanoethyl compound with air, O_2, H_2O_2, benzoyl peroxide, Pb_3O_4, etc. in a solvent at 40–150°C. Alternatively, certain amines and phenols react with tetracyanoethylene $(CN)_2C{=}C(CN)_2$ (prepared from sulphur monochloride and malonitrile) to give C-tricyanovinyl compounds directly by elimination of HCN. Thus

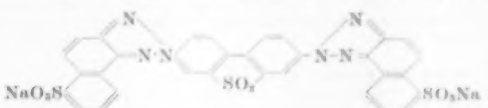


is prepared by refluxing dimethylaniline and tetracyanoethylene in tetrahydrofuran. The solvent is distilled and remaining blue compound is washed with diethylether and recrystallised from alcohol. E.T.

Fluorescent Brightening Agents

General Aniline *USP* 2,733,165

Fluorescent brightening agents of good affinity for cellulose and excellent fastness to chlorine are produced by diazotising aromatic diamines, coupling with an aromatic primary amine containing one chromophoric group and which couples *ortho* to its primary amino group, and oxidising the resulting dye so that a triazole ring is formed containing the N atom of the primary amine. Thus benzidine sulphone is heated with aqueous HCl to convert it to the hydrochloride. It is then tetrazotised at 5–10°C. and coupled in alkaline solution with 2-naphthylamine-5-sulphonic acid. The disazo dye so formed is filtered off, formed into an aqueous slurry and heated in a water bath with cupric sulphate in presence of ammonia to yield

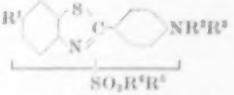


which has a bluer fluorescence than hitherto known sulphone fluorescent brightening agents. C.O.C.

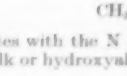
Fluorescent Brightening Agents

DuP *USP* 2,733,242

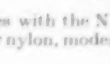
Fluorescent brightening agents of formula—



(R^1 = H or CH_3; R^2 and R^3 = Alk or hydroxyalkyl or together =



which completes with the N atom a morpholine ring; R^4 and R^5 = H, Alk or hydroxyalkyl or together =

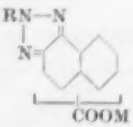


which completes with the N atom a morpholine ring) have good affinity for nylon, moderate to good affinity for cotton,

and good fastness to chlorine. They may be made by any convenient method. Thus *NN*-dimethyl-dehydrothio-*p*-toluidine, chlorosulphonated and then amidated with ammonia yields *NN*-dimethyl-dehydrothio-*p*-toluidine sulphonamide which is a highly effective fluorescent brightening agent for cotton, wool, silk, nylon and acetate rayon.

USP 2,733,247

Compounds of formula—

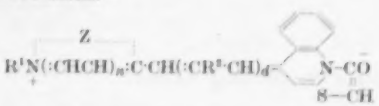


(R = radical of 2-phenylbenzothiazole and its homologues or a monosulpho derivative of these; M = H, alkali metal or NH_4) are fluorescent brightening agents of good resistance to chlorine and fluorescing blue. They may be made by diazotising 2-(*p*-aminophenyl)-benzothiazole, dehydrothio-*p*-toluidine or dehydro-thio-*m*-xylidine or their monosulpho derivatives, coupling (in acid medium) to a naphthoic acid having NH_2 in 1- or 2-position and oxidising the resulting dye. C.O.C.

Non-ionised Cyanine Dyes

Kodak *BP* 772,347

Dyes of formula—



(R¹ = Alk or aralkyl; R² = H, Alk or Ar; *n* and *d* = 0 or 1; Z = atoms to complete a 5- or 6-membered ring), e.g. anhydro-3-ethyl-1′-hydroxyoxa-5′-(thiazolo-[3,2-*a*]-quino)-carbocyanine hydroxide, are photographic sensitisers. C.O.C.

Fluorescent Compositions

Switzer Brothers *BP* 769,691

A mixture of resin particles of pigment size some of which are dyed with a "rhodamine dye", e.g. C.I. Basic Red 1 or C.I. Basic Violet 10, with similar particles dyed with 2:2′-dehydroxynaphthaldazine or a fluorescent derivative thereof, e.g. with Alk or Hal directly substituted into the naphthalene nucleus, is an intensely brilliant and daylight-fluorescent pigment of excellent fastness to light. C.O.C.

Fluorescent Pigments

American Cyanamid Co. *BP* 770,889

A pigment which fluoresces in visible light and in ultraviolet radiation comprises a 0·2–5·0% solid solution of a water-soluble fluorescent organic dye in a polymer or copolymer prepared from at least one vinyl type monomer. The resin must have a "number average particle size" $< 127\,\mu$. The "number average particle size" is determined by the formula—

$$\frac{n_1 D_1 + n_2 D_2 + n_3 D_3 \ldots n_n D_n}{n_1 + n_2 + n_3 \ldots \ldots n_n}$$

(n_1 = number of particles of diameter D_1, n_2 those of diameter D_2, etc.). The absorption band of the dye when apart from the resin and in a suitable solvent should be close in wavelength to its fluorescent emission band. 32 examples of such pigments are given. C.O.C.

Flushed Pigments

FBy *BP* 771,678

Powdered flushed pigments are obtained by adding an organic solution of a tall oil, a natural or synthetic resin or rosin or a salt, ester or other derivative thereof as flushing agent to an aqueous solution or dispersion of a compound, e.g. a diazo coupling component, which is subsequently converted into a pigment. On filtering the flushed pigment with suction a press cake is obtained which contains no water. This enables products of extraordinarily high tinctorial value to be formed because the water is displaced with a comparatively small portion of a hydrophobic agent. C.O.C.

2-Hydroxy-3-naphthoic-2′:5′-dimethylanilide as Azoic Coupling Component in Textile Printing (IX p. 349)
Behaviour of Organic Pigments in High-temperature Systems (XIII p. 355)
4-*p*-Phenylazophenylsemicarbazide and its Use in Chemical Analysis (XIV p. 356)
New Indicator for Complexometric Titration of Calcium in presence of Magnesium (XIV p. 359)
Determination of Thermodynamic Dissociation Constants from Absorption Spectra with Applications to *o*- and *p*-Phenylenediamines (XIV p. 360)
Metallochromic Indicators of the Complexone Type (XIV p. 360)

V—PAINTS; ENAMELS; INKS

Weathering Characteristics of Zinc Oxide Pigments

J. R. Rischbieth

J. Oil & Col. Chem. Assoc., **40**, 212–220 (March 1957)

Outdoor exposure trials have been conducted in Australia with paints containing a variety of ZnO pigments (42 in all) both alone and in mixed pigmentations, and linseed oil vehicles of varying acid values and bodied-oil contents. Zinc oxides giving chalk-prone finishes promote severe early chalking and premature failure by cracking and flaking; they are virtually unusable in exterior oil-type house-finishing paints. Chalk-resistant ZnO pigments do not accelerate the development of these defects. The manufacturing process employed is not the criterion of the weathering properties. Daily water-spraying (particularly under summer conditions) of the exposure panels accelerates the development of early chalking, but not of failure due to cracking and flaking. J.W.D.

Nepheline Syenite as an Extender Pigment for Paint

W. N. B. Armstrong and V. K. Croutch

Off. Dig. Paint Var. Prod. Cl., **29**, 272–288 (March 1957)

Nepheline syenite (I) is a white cryst. granular igneous rock, and is essentially a sodium potassium aluminium silicate. It is commercially available in micronised form (all finer than 325-mesh) of low oil absorption; this permits high loadings to be used without loss of gloss. In exterior house paints a blend of I with magnesium silicate (3 : 4) gives better performance than either filler when used alone; it gives to both oil and water paints very good brushing properties, levelling, and flow. In flat wall paints, both oil- and water-based, it improves colour uniformity, and in enamel undercoat paints it improves hold-out. Trials of the material are reported under these headings—outdoor exposure of exterior house paints, interior flat wall paints, latex paints, and metal priming paints. J.W.D.

Physical Chemistry of Paint Coatings

M. Van Loo

Off. Dig. Fed. Paint Varn. Prod. Cl., **28**, 1126–1156 (Dec. 1956)

A lengthy review, including many references to hitherto unpublished work, under several headings—vortex action, (promoted during drying by the evaporation of thinners), critical pigment volume concn., and durability of films and ultraviolet absorption. There are 6 photomicrographs and 16 diagrams and graphs. J.W.D.

Factors affecting Gloss and Colour Retention Characteristics of an Aircraft Lacquer

A. I. Falkowitz and W. A. Gottfried

Off. Dig. Fed. Paint Varn. Prod. Cl., **29**, 243–250 (March 1957)

Gloss and colour retention characteristics are influenced by the choice of plasticiser, alkyd resin, and pigments for any one colour, and by the ratio of the vehicle components (nitrocellulose, plasticiser, and alkyd); pigment loading is of little significance. The use of a melamine resin and an ultraviolet absorber have little effect upon gloss and colour retention. J.W.D.

PATENTS

Transfer Coating Compositions for Carbon Papers

Burroughs Corpn. *BP* 770,796

A transfer coating composition for carbon papers comprises a copolymer of 85–90% vinyl chloride and 15–10% vinyl acetate, a volatile solvent, a non-drying vegetable and/or mineral oil, and colouring matter. It

adheres strongly to but does not penetrate the backing paper and enables a coarser and less uniform textured backing paper to be used. C.O.C.

Water Paints based on Plasticised Vinyl Chloride–Vinyl Acetate Copolymers
ICI
BP 769,694

Pigmented, plasticised, aqueous dispersions of copolymers of $\geqslant$ 25% dry wt. of vinyl acetate and $\leqslant$ 75% of vinyl chloride are water paints of very good wash and scrub resistance (resistance to vigorous wet rubbing in presence of a detergent). C.O.C.

Stoving Lacquers
DuP
BP 771,549

The lacquer comprises pigment, solvent, saturated C_1–C_4 aliphatic monohydric alcohol modified melamine-aldehyde resin and alkyd resin. The ratio of melamine to alkyd resin is 15 : 85 to 40 : 60 by weight. The alkyd resin has (*a*) been modified with 30–40% by weight of coconut oil or fatty acids therefrom, (*b*) unesterified OH groups equivalent to 4–8% by weight of glycerine (3) acid number 9–16. It yields high gloss coatings of excellent resistance to weathering, hides scratches in the surface coated, can be stoved at moderate temperatures to give greater initial hardness than hitherto known lacquers, has good resistance to discoloration on high temperature baking or baking for longer than normal periods, and resists formation of sub-surface blisters during prolonged exposure. C.O.C.

VI— FIBRES; YARNS; FABRICS

Rheological Behaviour of Hydrogen-bonded Solids
A. H. Nissan

I— Primary Considerations
Trans. Faraday Soc., **53**, 700–709 (May 1957)

An equation is derived for the stress f occurring when a hydrogen-bonded solid is subjected to a tensile strain σ. For small strains $f = E\sigma - K\sigma^2$ where E is Young's modulus and K a second coefficient of elasticity. K is a general constant, for which a value of $1{\cdot}1 \times 10^{12}$ dynes/cm.^{2} is derived. Experimental results for paper, cellulose sheet, viscose rayon, and nylon confirm this value.

II— Derivative Phenomena
Ibid., 710–721

The influence of temperature on E is derived theoretically and found to agree with observation. Regain is found to influence E for cellulose in three ways. Initially and until one-third of the hydrogen bonds in the amorphous region are broken and saturated with water a simple formula fits experimental results. During the break-up of the remaining hydrogen bonds in amorphous regions a co-operative process occurs in which a number of bonds are broken per addition of a single water molecule. When all the amorphous regions are saturated with water the original behaviour returns. Stress relaxation in cellulose is studied as typical of time effects. The theory gives an explicit value for n, the number of hydrogen bonds strained per c.c. of sample. Relaxation phenomena can be explained by two reactions in which n decreases with time. W.R.M.

Effect of Long Storage on Cotton
E. E. Berkley
Text. Research J., **27**, 171–172 (Feb. 1957)

Details of two bales of raw cotton grown in 1862. The fibre shows no appreciable degradation. Yarns spun from this cotton compare favourably with samples from recent crop years. J.C.F.

Effects of Nuclear Irradiations on Cotton Yarn
E. S. Gilfillan and L. Linden
Text. Research J., **27**, 87–92 (Feb. 1957)

Effects on cotton yarn of irradiation with monoenergetic (2-Mev.) β-rays from a van de Graaff accelerator have been studied. At a dose of $4{\cdot}7 \times 10^6$ r. equiv. the strength of the yarn was reduced by ca. 30%. The principal degradation product is an acidic oxycellulose, and there is evidence that a cellulose peroxide is involved in its formation. It is suggested that the presence of antioxidants may be beneficial, particularly at lower doses. The presence of water vapour and atmospheric oxygen has little effect on the strength of irradiated yarn. J.C.F.

Lateral-order Distribution of Native Cellulose
Y. Tsuda and S. Mukoyama
Bull. Chem. Soc. Japan, **29**, 748–752 (Sept. 1956)

The lateral order of cotton linters, sulphate wood pulp, and sulphite wood pulp were measured by— (i) fractional dissolution in NaOH soln. after methanolysis, (ii) fall in D.P. after swelling and hydrolysis, and (iii) moisture regain measurement after swelling, and the results discussed. Of these three methods, fractional dissolution is held to give the most correct distribution. A.J.

Improving the Structure of Tyre-cord Yarns
A. B. Pakshver, L. S. Gerasimova, and Kh. N. Kozlovskaya
Colloid J. U.S.S.R., **19**, 104–108 (Jan.–Feb. 1957)

Thermostretching of viscose rayon and 6-nylon tyre-cord yarns increases the modulus of deformation by 10% and 80% respectively, resulting at the same time in improved stability of the molecular structure as shown by a decrease in the rate and the extent of adsorption of alkali (for viscose rayon) and phenols (for 6-nylon). Optimum thermostretching conditions are given for each fibre. G.J.K.

Floxan— Wool-type Viscose Rayon
W. Bandel
Textil Praxis, **12**, 219–223 (March 1957)

Floxan is a rayon staple manufactured by Spinnfaser A.G., of Kassel, Germany. It is cured during the coagulation process and has higher affinity for dyes than other cellulosic fibres, though below cuprammonium rayon in this regard. Scrooping is recommended after dyeing. It is of value in admixture with wool. B.K.

Further Evidence for the Existence of Three Different Free Hydroxyl Groups in Acetone-soluble Cellulose Acetate
J. F. Haskins and S. G. Sunderwirth
J. Amer. Chem. Soc., **79**, 1492–1493 (20 March 1957)

The free hydroxyl groups of an acetone-soluble cellulose acetate were replaced by tosyloxy groups which in turn were replaced by pyrrolidino groups. During the second reaction the acetyl groups were removed. Hydrolysis of the resulting pyrrolidinopolysaccharide yielded, besides D-glucose, three *N*-containing hexoses. Determination of the position of the pyrrolidino group in each hexose led to the conclusion that the free hydroxyl groups in acetone-soluble cellulose acetate are distributed among the 2-, 3-, and 6-positions of the anhydroglucose unit. C.O.C.

Load-extension Curve for Wool Fibres over the Decrimping Range
G. W. Walls
Proc. International Wool Textile Research Conf. Australia, **D**, D 118–D 133, D 258–D 261 (1955)

Measurements of wool fibre shape over a load range 10–1000 mg. have enabled an expression to be obtained which describes the load-extension curve over the decrimping region in terms of the physical properties and shape of the fibre. The expression contains two parameters only, both dependent on fibre shape and one also dependent on diameter and bending modulus of the fibre. These parameters were measured for fibres ranging from 70s merino to Lincoln at different humidities and in water at different pH values, in LiBr, and after reduction with thioglycollic acid. Observations were made on the variation of the elastic modulus in bending with that in extending the fibres. P.G.M.

Molecular Orientation and Configuration in Keratins
R. D. B. Fraser
Proc. International Wool Textile Research Conf. Australia, **B**, B 130–B 138, B 289–B 291 (1955)

Investigations of the infrared spectrum of wool in the 2-μ. region are described. Evidence is presented for a preferred orientation of the side-chain amide groups, which are also shown to be situated predominantly in the non-crystalline regions of the fibre. A value of the crystallinity is obtained by estimating the number of peptide linkages accessible to deuterium oxide, and this is compared with previous estimates and with an order of magnitude obtained by considering the histological structure. P.G.M.

Carboxyl Terminal Groups of the Peptide Chains of Wool Keratin
S. Blackburn and G. R. Lee
Proc. International Wool Textile Research Conf. Australia, **C**, C 142–C 143, C 474–C 475 (1955)
The *C*-terminal end groups of wool have been qualitatively determined by the method of hydrazinolysis followed by paper chromatography. The amino acids found were glycine, alanine, serine, and threonine.
P.G.M.

Infrared Spectra of Fibrous Proteins in the 2-μ. Region
R. D. B. Fraser
Proc. International Wool Textile Research, Conf. Australia, **B**, B 120–B 129, B 289–B 291 (1955)
The assignment of the combination bands which appear in the infrared spectra of fibrous proteins between 4200 and 5500 cm.$^{-1}$ is discussed on the basis of the normal vibrations of an isolated CO·NH group. Equations relating the degree of molecular orientation in a protein fibre with transition-moment direction and dichroic ratio are derived, and the assignment of the transition-moment direction associated with certain vibrations is considered.
P.G.M.

Fibre Formation in Natural and Synthetic Polypeptides
F. Happey
Proc. International Wool Textile Research Conf. Australia, **B**, B 153–B 175, B 293–B 294 (1955)
Work concerning the preparation and properties of fibres from natural and synthetic polypeptides is discussed. The information is related to the biophysical characteristics of wool and wool proteins.
P.G.M.

Amino-acid Composition of Wool
M. C. Corfield and A. Robson
Proc. International Wool Textile Research Conf. Australia, **C**, C 79–C 86, C 465 (1955)
Data are presented for the complete amino-acid analysis of a single sample of Australian merino 64s wool, obtained by the application of the Stein and Moore starch-column chromatographic techniques, together with radiometric and ninhydrin-photometric determination of the amino acid fractions. Other methods of analysis for certain amino acids were applied directly to the keratin hydrolysate. The data are examined critically, with special attention to tryptophan, cystine, and amide nitrogen, and compared with those obtained by Simmonds and by other workers.
P.G.M.

Variations in the Amino-acid Composition of Merino Wool
D. H. Simmonds
Proc. International Wool Textile Research Conf. Australia, **C**, C 65–C 74, C 460–C 465 (1955)
The complete amino-acid compositions of 16 samples of merino wool have been determined. Four sheep, representing coarse- and fine-woolled merino strains, were sampled in duplicate at the midside and rump positions. There were no significant differences for any of the amino acids between samples taken from the same sheep. There was no variation between sheep or between strains, with alanine, arginine, amide, glutamic acid, histidine, *iso*-leucine, leucine, lysine, methionine, proline, serine, tryptophan and valine. There were significant differences between sheep, but not between strains, with aspartic acid, cystine, glycine, phenylalanine, and threonine. Tyrosine was the only amino acid which differed between strains, the coarse strain having significantly less than the fine. The sum of the individual amino acid nitrogens accounted for an average of 94·87% of the total nitrogen. The sum of cystine, methionine, and "hydriodic acid reducible" sulphur accounted quantitatively for the sulphur present in the wool samples. The nature of "hydriodic acid reducible" sulphur is being examined; it is believed to be present in the elementary form.
P.G.M.

Dipole Interaction of Amide Groups in Keratin
M. Feughelman
Proc. International Wool Textile Research Conf. Australia, **B**, B 151–B 152, B 292–B 293 (1955)
A calculation of the dipole moment of the amide group in keratin has been made, and it is suggested that dipole forces due to the amide group could be an important, if not the main, structure factor in α-keratin.
P.G.M.

X-Rays and the Stoichiometry of Keratin— a Renewed Enquiry
W. T. Astbury
Proc. International Wool Textile Research Conf. Australia, **B**, B 202–B 219, B 299 (1955)
The paper describes a renewed attempt to correlate the findings of X-ray diffraction with those of chemical analyses in order to discover something about the order in which amino acid residues follow one another in the keratin molecule. The polypeptide configuration assumed was the Pauling–Corey α-helix, which was considered in relation to the X-ray meridional intensities within the macroperiod of 198A, and the probable chemical make-up of the more crystalline regions of the complex. A one-dimensional Patterson diagram has been constructed, and calculations on plausible distributions made to try to reproduce the required structure amplitudes.
P.G.M.

Some Possible Modifications of the α-Helix and Speculations on the Possibility of Intrachain Disulphide Bonds in α-Keratin Structures
H. Lindley
Proc. International Wool Textile Research Conf. Australia, **B**, B 193–B 201, B 296–B 298 (1955)
The application of ideas arising from investigations on building chemical models for insulin to α-keratin structures are discussed. Although the suggestions advanced are speculative, they provide satisfactory alternatives to previous explanations of some aspects of α-keratin structure.
P.G.M.

Comparison of the Reactivity of the Disulphide Bond in Wool and Peptides
P. Alexander and M. Fox
Proc. International Wool Textile Research Conf. Australia, **C**, C 35–C 48, C 456–C 457 (1955)
Oxidation of various cystine peptides by chlorine (pH 2 and 10) and potassium permanganate (pH 2 and 9·2) failed to reveal any effect of the position of cystine in the peptide chain on this reaction. The cystine of peptides also containing tyrosine is not completely oxidised by chlorine at either pH, nor is it preferentially attacked by acid permanganate, although non-tyrosine peptides show both these types of behaviour. The clear-cut division of the disulphide bonds in wool into 25% oxidisable by acid permanganate and hypochlorite, and 75% not thus oxidisable can therefore not be explained by the way in which they are incorporated into the peptide chain, though the proximity of a tyrosine residue affects the reactivity of cystine residues with oxidising agents.
P.G.M.

Effect of the Breaking of Cystine Linkages on the Mechanical Properties of Wool Fibres
H. Sobue
Proc. International Wool Textile Research Conf. Australia, **D**, D 83–D 87 (1955)
Wool was immersed in 0·18N-thioglycollic acid solution at pH 5·6 and 35°C. for 20 hr. This was found to break 80% of the cystine linkages without producing disintegration of the fibre. Stress–strain curves of the original and the treated wools were determined in both air and water. No significant change in the mean breaking strength in air was produced by the treatment, and the Young's modulus of the treated fibre was generally smaller than the original value. In repeated elongation experiments it was found that the treatment produced a significant change in the hysteresis displayed in water. An equation describing the load–elongation curves of wool is given.
P.G.M.

Molecular-Mechanical Model of Wool Keratin
L. Peters
Proc. International Wool Textile Research Conf. Australia, **D**, D 71–D 82, D 253–D 254 (1955)
A molecular-mechanical model has been devised to describe the viscoelasticity of the wool keratin fibre. The elastic extension is interpreted in terms of hydrogen-bond stretching, which is assumed to be described by the Morse equation. The equation predicts for keratin the influence of stress on the rate of the creep due to unfolding of part of the polypeptide chains unhindered by disulphide bonds, i.e. the reversible 30% extensibility. In this way

the viscous behaviour is related to the elastic properties. Disulphide-bond hydrolysis permits a further 70% extension in two stages. From data of the equilibrium creep of wool fibres under constant load in water, the theory successfully predicts the stress coefficient of the rate of creep and the magnitude of Young's modulus for either wet or dry keratin fibres. The high activation energy of creep is explained as the heat of hydration of peptide bonds involved in the "release" of hydrogen bonds between peptide groups. The theory as a whole provides a reasonably consistent interpretation of many apparently unrelated phenomena. Its applicability to other viscoelastic properties is suggested. P.G.M.

Mechanical Properties of the α → β Transformation in Natural Keratin Fibres

A. L. Ruoff and H. Eyring

Proc. International Wool Textile Research Conf. Australia, **D**, D 9–D 25, D 249–D 250 (1955)

The viscoelastic properties of natural keratin fibres are described in terms of molecular models. Elastic deformation is shown to follow Hooke's law and the method of studying elastic deformation independently of other processes is described. Over the temperature range studied Hooke's constant is temperature-independent, which indicates that the elastic deformation of hair or wool is determined by internal-energy changes. A method of obtaining the equilibrium curve for the $\alpha \rightarrow \beta$ transformation is discussed and applied. The free-energy difference between the two states is 4,700 cal. Rate studies were made at a rate such that the $\alpha \rightarrow \beta$ transformation and elastic deformation could be measured independently of the slow, plastic flow, processes. The $\alpha \rightarrow \beta$ transformation rate is described in terms of a two-state model as used by Speakman and by Burte and Halsey. The free energy of activation is 22,300 cal. Temperature studies of both the equilibrium and rate of the $\alpha \rightarrow \beta$ transformation in water were made. A method for studying plastic flow in natural keratin fibres, independently of other processes occurring, is discussed. P.G.M.

Extension, Contraction, and Supercontraction of Wool Fibres

R. W. Burley

Proc. International Wool Textile Research Conf. Australia, **D**, D 88–D 117, D 255–D 258 (1955)

It is postulated that thiol–disulphide interactions take place under certain conditions in keratinous fibres and that the rearrangement of disulphide bonds brought about in this way is responsible for many of the anomalous facts about the length changes of these fibres. In particular, the weakening of wool fibres after long-range extensions in water is assumed to be due to the displacement of many of the disulphide bonds conferring longitudinal stability, and restrengthening after contraction is assumed to be largely due to the re-formation of the same or equivalent disulphide bonds. The supercontraction of wool fibres in solutions of certain swelling agents, such as hot aqueous phenol, is assumed to be made possible largely by a thiol-induced rearrangement of disulphide bonds. The following observations are advanced as evidence for these views: Wool fibres contain thiol groups whose concentration is not permanently altered by either long-range extensions in water at room temperature or supercontraction in hot aqueous phenol. Both the rate of extension and the % supercontraction depend on the concentration of thiol groups; extension is slower and supercontraction less after treatments that remove thiol groups. The rate and extent of contraction after releasing a fibre from long-range extension are not greatly dependent on the concentration of thiol groups, unlike the recovery of strength after contraction which is less in the absence of these groups. Fibres cannot be stretched to large extensions in conc. formic acid, and in hot conc. formic supercontraction is relatively small. P.G.M.

Swelling Properties of Wool Fibres

M. Leveau, N. Varney-Cebe, and A. Parisot

Proc. International Wool Textile Research Conf. Australia, **D**, D 211–D 219, D 267–D 268 (1955)

The authors consider the relation between the felting and fibre swelling properties of wool. They show that felting can be considered as arising from the tendency of fibres to bend when they are placed in media which cause the unequal swelling of the two cortical fractions. It is considered, however, that other physical properties such as friction or flexing must equally play a part in felting. P.G.M.

Wool Protein Complex and its Hydrothermal Instability

F. G. Lennox

Proc. International Wool Textile Research Conf. Australia, **B**, B 22–B 34, B 269–B 272 (1955)

The need is stressed for enlarging present knowledge of the structure of wool, particularly in respect of the number and properties of the proteins present. The preparation and the properties of three protein components in pH 12·6 0·1M. thioglycollate extracts of wool of varying quality is described. Evidence is presented for two additional minor components in pH 10·5 thioglycollate extracts and for the removal of the less important components by fivefold extraction with this solvent. This allows recovery of the major protein, component 2, electrophoretically pure, by extraction with pH 12·3 0·1M. thioglycollate. The amino acid composition and some properties of component 2 are discussed. The quantity of protein extracted with pH 10·5–11·0 thioglycollate diminishes sharply if the wool is previously heated in water: 40 min. at 70°c. produces a detectable effect, and the solubility falls to 25% of the original on heating for 40 min. at 120°c. Dry heat has far less effect. Wool cells yield protein to alkaline thioglycollate more readily than does intact wool, and heating in water to 120°c. does not lower their extractability to the same extent as is observed for wool. The close resemblance is emphasised between the production of hydrothermal changes in wool proteins and corresponding changes in other fibrous and globular proteins. P.G.M.

Interaction of Wool and Water

I—Diffusion of Water in Wool Fibres

A. R. Haly and N. F. Roberts

Proc. International Wool Textile Research Conf. Australia, **D**, D 182–D 194, D 263–D 267 (1955)

A number of curves of regain against time for wool fibres have been obtained under conditions which ensured that the regain changes were determined solely by diffusion in individual fibres. Curves relating regain and time for wool fibres and for horn were calculated using King's (1945) values of the coefficient of diffusion of water in horn. For both wool and horn the calculated curves are in fair agreement with the experimental curves in desorption, but in marked disagreement in absorption, the latter occurring during the early stages at a rate which is only about one-seventh of that predicted by the calculations. These results are consistent with suggestions made about certain other high polymers, viz., that a finite time is required for adjustment of the diffusion properties of the fibre to a new concentration. Regain–time curves were also calculated on the assumption that part of the water is immobilised, the diffusion coefficient of the mobile fraction being constant. The values obtained for this diffusion coefficient indicate that Cassie's (1945) values for the fraction of water which should be considered mobile are more likely to be correct than those given by an assumption common in diffusion calculations. P.G.M.

II—Rates of Swelling of Single Fibres following Absorption of Water from the Liquid Phase

A. R. Haly

Ibid., D 195–D 201, D 263–D 267

Lincoln wool fibres were dried and immersed in water. The subsequent rate of swelling of the diameter was determined using a microscope. The diametral swelling was found to be approximately a function of time/(diameter)^2, and with a fibre of 28 μ. diameter 95% of the change took place in about 15 sec. Photomicrographs show that, as absorption proceeds, there is a concentration gradient in the fibre, and therefore that the absorption rate is at least partially diffusion-controlled. The kinetics of absorption and desorption of water are discussed, and it is concluded that anomalous behaviour is largely due to stresses between differently swollen parts of the fibre. P.G.M.

III—Kinetics of Vapour Sorption in Single Fibres: a New Technique and some Preliminary Results

J. G. Downes and B. H. Mackay

Ibid., D 202–D 210, D 263–D 267

A technique is described which permits precise measurement of the rate at which the amount of sorbed vapour in

single fibres changes as a result of changes in external vapour pressure. Changes of the order of 1 part in 1000 in the mass of a single fibre can easily be detected. Some preliminary results for wool fibres are presented. Small changes in relative humidity cause sorption and desorption processes which occur in two distinct stages. The second stage is much longer in duration than the first and occupies some hours. The diffusion process in the first stage may be in accordance with Fick's law; the second stage is considered to represent a slow opening-up of the molecular structure as a result of the swelling pressure. The time to reach final equilibrium in sorption is less for large changes in relative humidity than for small; this may be due to a "yield" region being reached in the relevant mechanical properties of the fibre under the influence of the swelling stress. P.G.M.

Sorption of Acids by Wool
P. Larose and R. Donovan
Proc. International Wool Textile Research Conf. Australia, **B**, B 106–B 113, B 287–B 288 (1955)

The sorption of hydrochloric acid and sulphuric acid by wool in mixtures of these acids in water was measured with a view to determining whether the Donnan equilibrium theory or the Gilbert–Rideal theory was better in representing the results. The results indicated that the sorption of hydrochloric acid obeys the Donnan theory better, but that the sorption of sulphuric acid is equally well represented by either theory. Calculations based on data obtained with weak acids by Steinhardt, Fugitt, and Harris (1943) indicate that wool is able to sorb acids in the undissociated molecular form in the same way that wool readily sorbs gaseous HCl. Both phenomena are represented by isotherms of the Freundlich type. Experiments with nylon and other fibres have shown that part at least of this sorption may be due to the amide groups in the wool. Certain ions may also be sorbed in the same way, but in this case the maximum combining capacity is still limited by the charged groups in the wool.
P.G.M.

Preparation of Wool Protein Solutions
I. J. O'Donnell and E. F. Woods
Proc. International Wool Textile Research Conf. Australia, **B**, B 48–B 55, B 272–B 274 (1955)

Various methods of dissolving wool are critically discussed to discover which method produces the best solution for study by physical methods. It is concluded that most information is likely to be obtained from solutions made from wool in which all the disulphide bonds have been permanently severed either by repeated reduction and alkylation, or by oxidation. The likely causes of insolubility of wool are also considered.
P.G.M.

Chemical Modifications of the Surface Layer of Wool and their effect on Wettability and Sorption Properties
L.Wikstroem, E. Soervik, M. Cednaes, and B. Olofsson
Proc. International Wool Textile Research Conf. Australia, **C**, C 257–C 276, C 489–C 490 (1955)

The surface-modifying effects on wool of acid, alkaline, oxidising, reducing, etc. agents in organic solvents, of enzymes, and of pure solvents, have been investigated. These effects were generally measured as the change in wettability. More extensive work was carried out on hydroxyl ions (KOH–butanol) and organic solvents, where concentration, time, and temperature effects were investigated and also the sorbed amounts of KOH as well as the amounts extracted by solvents were measured. In some cases measurements of moisture sorption velocities and moisture equilibrium sorptions were made. Generally, an increased wettability was correlated with an increased absorption of OH ions as well as an increased extracted residue, and also with increased moisture diffusion constants and moisture equilibrium sorption. Measurements of sorption velocities and amounts absorbed of long-chain acids and bases in ethanol, however, failed to distinguish untreated and surface modified samples.

The results are consistent with the theory that the treatments make the surface layer more polar in character. The attack, however, is not restricted to the "mathematical" surface, although it is never so large as to modify the internal mechanical properties of the fibre. Chemically, the cystine links appear to be the modified groups. For the action of solvents the theory of an extractable surface layer is also consistent with the results. The effect of some enzymes may be explained by the existence of non-protein components. P.G.M.

Changes in the Properties of Wool with Methylation
M. Oku and I. Shimizu
Proc. International Wool Textile Research Conf. Australia, **C**, C 294–C 301, C 491 (1955)

In order to produce significant changes in the properties of wool and to elucidate the rôle of tyrosine residues in wool keratin, it has been methylated with diazomethane and esterified with methanolic HCl. When wool is methylated with diazomethane, about 78% of the total tyrosine in wool is methylated and about 67% of the available carboxyl groups are also methylated, a maximum methoxyl content of 2·39% has been attained. Acid and alkali solubility of methylated wool in this way increases remarkably, in parallel with methoxyl content, and about 62% of methylated wool of 2·39% methoxyl content is dissolved by treatment with 0·1*N*-NaOH at 65°c. for 1 hr. Other treatments such as esterification, amidification, and dinitrophenylation do not bring about such a marked increase of alkali solubility. The reasons for this increase are discussed and it is postulated that methylated tyrosine residues in wool are responsible. P.G.M.

Pretreatments which affect the Susceptibility of Wool to Proteolysis. I—Effects of pH, Wetting Agents, and Solvent Extraction
W. G. Crewther
Proc. International Wool Textile Research Conf. Australia, **C**, C 227–C 256, C 486–C 489 (1955)

The digestion of solvent-extracted Corriedale wool (batch A) by trypsin solutions at pH 8·0 was shown to be markedly increased by pretreatment of the wool for 20 hr. at 20°c. in buffer at pH 11. Similar wool extracted with solvents in a different sequence (batch B) was almost unaffected by a similar alkali pretreatment, but wool from this batch became susceptible to attack by trypsin if treated with sodium bisulphite, heated in distilled water, or autoclaved, before alkali pretreatment. Likewise the susceptibility of wool boiled in buffers increased with increasing pH values of the buffers.

Pretreatment of wool (A or B) with alkaline solutions of soap increased the extent of proteolysis. This effect was also pH-dependent and at 30°c. was maximal with sodium caprate (a solubility effect); at 50°c. palmitate and stearate were more effective. Pretreatment with alkaline solutions of other anionic wetting agents also increased the digestion of wool by trypsin, but the non-ionic wetting agent Lissapol NX caused a relatively small increase in digestion. The cationic agent cetyltrimethylammonium bromide (CTAB) at pH 11 did not increase susceptibility to proteolysis at 30°c. but increased susceptibility a little when used in high concentration at 50°c.

The effects of alkali on batch A wool and of alkaline solutions of wetting agents on batch B wool were reversed by soaking in acetate buffer at pH 4·0, but the reversal in the latter case, at least, was only partial. Repetition of alternate acid and alkaline treatments after pretreatments in caprate, resulted in progressively greater susceptibility to trypsin of both the acid- and alkali-pretreated wool samples.

Low concentrations of both cationic and anionic wetting agents protected wool of batch A against the effects of alkaline pretreatments. In general, CTAB was more effective for this purpose than the anionic wetting agents. No such protective effect could be demonstrated with the non-ionic wetting agent.

It is suggested that the trypsin test is a measure of the disordering (denaturising) of certain proteins of the fibres and that the effects of wetting agents in alkaline solutions are attributable primarily to rupture of non-peptide linkages between wool protein "molecules". The consequent greater freedom of molecular movement permits reversible changes of configuration which favour proteolysis.

The relevance of the results to the digestion of wool by insects and micro-organisms and to the reactions taking place in certain wool textile processes is discussed.
P.G.M.

Wool Gelatins. I— Isolation of Acid Peptides from Cold-water Extracts
H. Zahn and J. Meienhofer
Proc. International Wool Textile Research Conf. Australia, **C**, C 62–C 64, C 458–C 459 (1955)
The composition of some peptides isolated from cold-water extracts of wool and separated chromatographically have been determined. P.G.M.

Amino-acid Composition of Protein Fractions extracted from Wool
D. H. Simmonds and I. G. Stell
Proc. International Wool Textile Research Conf. Australia, **C**, C 75–C 78, C 460–C 465 (1955)
The amino-acid composition of three protein fractions, extracted with alkaline thioglycollate solutions from merino wool of 64s quality, have been determined. They are compared with the composition of the original wool. Extract A, consisting of the material most readily extracted at pH 10·5, is characterised by having a higher concentration of cystine, glycine, phenyl alanine, proline, serine, and tyrosine, and a lower concentration of alanine, arginine, aspartic acid, amide nitrogen, glutamic acid, *iso*leucine, leucine, lysine, and valine than the wool from which it was derived. Extract E, the material extracted last by treatment with pH 10·5 thioglycollate, differed in certain respects, particularly in its histidine, arginine, and phenylalanine content, from both extract A and the kerateine 2 fraction extracted at pH 12·3. The latter is characterised by containing more alanine, aspartic acid, amide, glutamic acid, leucine, and lysine, and less cystine, proline, serine, and tryptophan, than the parent wool. P.G.M.

Lanthionine Formation from Wool and Cystine
A. Schoeberl and A. Wagner
Proc. International Wool Textile Research Conf. Australia, **C**, C 11–C 17, C 452–C 456 (1955)
The treatment of uncombined cystine with alkali leads to the formation of lanthionine, which can be detected or isolated by paper chromatography. Lanthionine has been oxidised with bromine to a monoxide, which can be used for the identification of the thioether. The dehydroalanine compound formed as an intermediate from cystine can lead to either alanine or lanthionine. Further evidence for dehydroalanine as an intermediate may be deduced from the formation of alanine by the decomposition of cysteine thioethers by alkali. There is no difference in principle between the lability of the – S·S – bonds in wool and cystine. In all cases the formation of mercapto groups and elementary sulphur as well as H_2S may be observed. Sulphur balances can be made up in such systems by reduction with HI. In order to explain the formation of lanthionine in wool by a method such as treatment with Na_2CO_3, unequivocal sulphur balances must be obtained. P.G.M.

Lanthionine Formation in Wool
H. Zahn and F. Osterloh
Proc. International Wool Textile Research Conf. Australia, **C**, C 18–C 24, C 452–C 456 (1955)
Cystine residues in wool are largely transformed into lanthionine when fibres are treated at 65°C. and pH 9–11 with aqueous solutions containing at least 60% (vol./vol.) of ethanol, propanol, acetone, dimethylformamide, tetrahydrofuran, or dioxan. Lanthionine is shown to be present in hydrolysates of dry wool which have been heated to above 150°C. The hydrolysates of various chemically modified wools contain the sulphoxide of lanthionine. P.G.M.

Molecular Weights of some Wool Keratin Derivatives
B. S. Harrap
Proc. International Wool Textile Research Conf. Australia, **B**, B 86–B 91, B 283–B 285 (1955)
Determinations have been made of the molecular weights at the air–water interface, under varying conditions of pH and ionic strength, of three fractionated wool keratin derivatives in which the disulphide bond had been reduced to thiol, reduced and treated with iodoacetic acid, and oxidised to sulphonic acid, respectively. It is shown that all derivatives aggregate in certain ranges of pH and ionic strength but that the minimum subunit for all three derivatives is in the vicinity of 8,000. The aggregation–disaggregation phenomena are interpreted in terms of the effects of pH and ionic strength on the balance between Coulombic and non-Coulombic forces in the system. P.G.M.

Physicochemical Study of the Soluble Protein from Wool oxidised with Peracetic Acid
I. J. O'Donnell and E. F. Woods
Proc. International Wool Textile Research Conf. Australia, **B**, B 71–B 85, B 278–B 283 (1955)
The effect of pH, time, and ionic strength on electrophoresis, viscosity, and sedimentation has been studied for α-keratose, a protein derived from wool oxidised with peracetic acid. While electrophoresis, except under certain conditions, does not obviously indicate heterogeneity of this protein, sedimentation measurements reveal marked heterogeneity, which is interpreted in terms of aggregation–disaggregation phenomena. The sedimentation pattern is simplified considerably by the addition of small amounts of sodium dodecyl sulphate. α-Keratose is not readily fractionated into components. P.G.M.

Macromolecular Structure of Wool— the Terminal Amino Acids of the Fractions obtained after Oxidation with Peracetic Acid
P. Alexander and L. F. Smith
Proc. International Wool Textile Research Conf. Australia, **B**, B 56–B 70, B 275–B 278 (1955)
The preparation of α-, β-, γ-keratoses by treating wool with dilute peracetic acid and extracting with ammonium hydroxide is described. The *N*-terminal amino acids of these protein extracts and fractions prepared from them are compared with those of whole wool using the F.D.N.B. reagent of Sanger. The average chain weight determined in this way is compared with molecular weights determined by physical methods. It is suggested that α-keratose is derived from the micelles or subfibrils, γ-keratose from the intermicellular substance which cements the whole together through disulphide bonds, and β-keratose from the cell membranes surrounding the cortical cells. P.G.M.

Electrophoretic Properties of Kerateine 2 (Component 2) and some of its Derivatives
J. M. Gillespie
Proc. International Wool Textile Research Conf. Australia, **B**, B 35–B 47, B 269–B 272 (1955)
The preparation and the properties of chemical derivatives of an electrophoretically pure wool protein are described. This protein, previously referred to as "Component 2", is now designated *kerateine* 2 to indicate its relationship to the reduced wool proteins previously described as "kerateine" by Goddard and Michaelis (1935).
Derivatives of kerateine 2 are prepared by replacing the H atoms in the thiol groups through treatment with an iodoacetate, iodoacetamide, *p*-chloro-mercuribenzoate, methylmercury iodide, and benzyl chloride or by removing the sulphur from these groups by means of Raney nickel.
These derived proteins differ in their solubilities and in their precipitation points and, in general, show abnormal electrophoretic behaviour, probably owing to interactions similar to those observed with kerateine 2.
Like kerateine 2, the derivatives containing no free thiol groups show a reduced solubility in alkaline solutions after the application of pressure to the acid precipitates. The fact that this insolubilisation is reversed by urea suggests that it is brought about by hydrogen-bond formation. P.G.M.

Effect of Nitric Acid on Wool
C. S. Whewell and M. A. da Silva
J. Textile Inst., **48**, T 98 (March 1957)
Wool fibres treated with 100% nitric acid at room temperature for 18 hr. neither supercontract nor acquire a permanent set when extended and immersed in boiling water. This may be due to steric hindrance from nitro groups introduced into tyrosine residues or from nitro groups resulting from the oxidation of amine groups. Alternatively, new cross-linkages may be formed. A further publication about the work is promised. P.T.S.

Theory of Stress Relaxation— Relaxation in Wool and *iso*Butylene Polymers
T. Ree, S. J. Hahn, and H. Eyring
Proc. International Wool Textile Research Conf. Australia, **D**, D 234–D 248 (1955)
Stress relaxation can be treated as a unimolecular reaction. Equations are given for the rate of the unimolecular reaction and the rate of relaxation. The latter

has been applied to the stress relaxations in wool fibres and *iso*butylene polymers with good results. The relaxation in wool (at 15% elongation and 30–80°c. in water) is characterised by a high positive activation heat (45·3 kcal./mole) and high positive activation entropy (44·9 cal./°c./mole), while a reasonably low activation heat (13·3 kcal./mole) and high negative activation entropies (−31·4 to −46·3 cal./°c./mole) are associated with the relaxation in *iso*butylene polymers. The relaxation in wool is explained by the $\alpha \rightarrow \beta$ transition, and that in poly*iso*butylene by the slippage accompanying disentanglement. A detailed discussion is given for the assumptions mentioned above. P.G.M.

Structure of Tussah Silk Fibroin— with a note on the Structure of β-Poly-L-alanine
R. E. Marsh, R. B. Corey, and L. Pauling
Proc. International Wool Textile Research Conf. Australia, **B**, B 176–B 186, B 294–on (1955)

A detailed structure for Tussah silk fibroin has been derived which is in agreement with the X-ray diffraction data. The structure is similar to that of *Bombyx mori* fibroin in that it is based on antiparallel-chain pleated sheaths; the method of packing of the sheets, however, is quite different. This difference in packing can be explained on the basis of the chemical compositions of the two silks. It seems highly probable that the structure of the β (stretched) form of poly-L-alanine is essentially that derived for Tussah silk. P.G.M.

Structure of the Silk of Green Lace-wing Fly (*Chrysopa*) Egg Stalks
K. D. Parker and K. M. Rudall
Nature, **179**, 905–906 (4 May 1957)

Chrysopa egg stalks are fine positively birefringent fibres. X-Ray diffraction diagrams and infrared absorption suggest that β-polypeptide chains lie at right angles to the fibre axis. There is some X-ray evidence for a superlattice or another configuration of the protein. When stretched in water the fibres become more positively birefringent and give an X-ray diffraction pattern resembling those for wild-type silks and indicating extended polypeptide chains parallel to the fibre axis. There is no obvious long-range elasticity and the stretched fibres do not contract significantly on release in water. Polarised infrared absorption measurements support the conclusions obtained from X-ray studies. W.R.M.

Amino-acid Composition of the Silk of *Chrysopa* Egg Stalks
F. Lucas, J. T. B. Shaw, and S. G. Smith
Nature, **179**, 906–907 (4 May 1957)

Amino-acid analysis shows that glycine, alanine, and serine account for 84·4% of the total protein. This is similar to the total of the same amino acids in the silk fibroin of *Bombyx mori*, but the serine content is much higher in *Chrysopa*. The ratio of serine : alanine : glycine is approx. 2 : 1 : 1, and it is possible that sequences of the form Ser.Gly.Ser.Ala. occur in the protein. W.R.M.

World Man-made Fibre Index
P. Lennox-Kerr
Silk and Rayon, **31**, 285–289 (March 1957)

Molecular Structure of High Polymers. XVII— Intermolecular Structure of Thermoplastic Fibres
A. B. Pakshver, É. E. Natan, and I. F. Katushkina
Colloid J. U.S.S.R., **19**, 109–112 (Jan.-Feb., 1957)

Stretching of thermoplastic fibres strengthens intermolecular bonds in polyacrylonitrile (I), polyvinyl chloride (II), and cellulose acetate (III) fibres, and is coupled with decreased adsorption of I for phenol, and of II and III for acetone. An increase in the modulus of deformation and in the coefficient of diffusion of various substances is claimed. G.J.K.

Effect of Strong Swelling Agents on the Infrared Absorption Spectra of Nylon
D. S. Barmby and G. King
Proc. International Wool Textile Research Conf. Australia, **B**, B 139–B 150, B 291–B 292 (1955)

It has been found that silk and nylon are soluble in arsenic and antimony trichlorides with little apparent molecular-chain degradation. The effect of these swelling agents, and also of phenol and formic acid, on the NH and CO infrared absorption bands of these polymers has been examined. The results suggest that the trichlorides break NH . . . CO hydrogen bonds in both the crystalline and amorphous fractions of nylon, whereas phenol and formic acid penetrate only a small amorphous fraction. Silk precipitated from antimony trichloride was found to show the same modification of the CO absorption band as α-silk produced by precipitation from LiBr solution. P.G.M.

Nuclear Magnetic Resonance of High Polymers (Phase Transition of Polyvinyl Alcohol Fibres)
K. Tanaka, K. Yamagata, and S. Kittaka
Bull. Chem. Soc. Japan, **29**, 843–844 (Sept. 1956)

PATENTS

Rendering Regenerated Cellulose Fibres Uniformly Dyeable with Direct Dyes
Phrix-Werke *BP* 771,328

The fibres are treated in a 0·9–4·0% aqueous solution of a compound obtained by treating glyoxal with methylol urea in neutral or alkaline medium. The pH of the solution is maintained between 3·5–6·0 by addition of an acid catalyst and the impregnated material is dried at > 85°c. There is little change in the swelling value of the fibres but they are readily dyed levelly with all classes of direct dyes. C.O.C.

Imparting Affinity for Acid Dyes to Cellulose Esters
BrC *BP* 771,011

Acetate rayon having affinity for acid dyes is obtained if 1–4% by weight of epoxyamines, amine diols in which an open carbon chain carries two hydroxyl groups, and mono-hydroxy alkanol amines containing two tertiary N atoms, are added to the spinning dope. Suitable compounds are 1-diethylamino-2:3-epoxypropane, 1-diethylamino-2:3-propanediol and 1:3-bis-diethylaminopropanol-2. C.O.C.

Crystallite Orientation in Cellulose Fibres (X p. 349)

Relations between the Chemical Composition of Alkali Cellulose and the Kinetics of Fibre Xanthation (XI p. 353)

X-Ray Diffraction Patterns and $\alpha \rightarrow \beta$ Transformation of a Protein extracted from the Human Epidermis (XII p. 353)

Composition of Epidermis (XII p. 353)

Reactivity of the Disulphide Bonds in Wool and Hair— Synthesis and Properties of Unsymmetrical Disulphide-dicarboxylic Acids (XII p. 355)

Synthesis and Lanthionine-forming Properties of some Derivatives of Cystine (XII p. 355)

Chromatography on Ion-exchange Resins applied to the Reaction of Wool Keratin with Alkali (XIV p. 358)

Amide Nitrogen in Proteins (XIV p. 362)

VII— DESIZING; SCOURING; CARBONISING; BLEACHING

Enzymatic and Chemical Properties of Crystalline Papain
E. L. Smith and J. R. Kimmel
Proc. International Wool Textile Research Conf. Australia, **C**, C 199–C 216, C 484–C 485 (1955)

Some of the physical, chemical, and enzymatic properties of crystalline papain are presented. Studies of the amino-acid sequence of this enzyme are given with particular reference to the cysteic acid peptides obtained from the protein oxidised with performic acid. The oxidised protein has been hydrolysed with trypsin, the resulting peptides have been separated by chromatography on Dowex 50–X2, and several of the peptides have been analysed. Further work should establish the composition and sequence of these peptides. P.G.M.

Micelles of Surfactants. I— Interior Phase
H. Sasaki, H. Okuyama, and S. Saito
Bull. Chem. Soc. Japan, **29**, 752–757 (Sept. 1956)

From the spectral changes of the π (or R), π (or K), and B bands of azobenzene, Yellow OB, anthracene, and phenanthrene in soln. of surfactants it is concluded that the surfactant micelle contains some water, at least for surfactant concn. up to 10%. A.J.

Adsorption of Water Vapour by Gelatin-detergent Complexes

K. Tamaki and B. Tamamushi

Bull. Chem. Soc. Japan, **29**, 731–733 (Aug. 1956)

The adsorption of water vapour by gelatin–dodecyl sulphate and gelatin–dodecylammonium complexes is less than that of pure gelatin, and adsorption by the anionic complex is always less than by the cationic. The reduction in the amount of the first monolayer adsorption of the complexes compared with that of pure gelatin is parallel to the proportion of complexed detergent, but there is no stoichiometric relation. A.J.

Activated Oxidation of Cellulose with Hypochlorite

E. D. Kaverzneva, V. I. Ivanov, and G. A. Krylova

Izvestiya Akad. Nauk. S.S.S.R. otdel. khim. nauk, 120–122 (Jan. 1957)

Oxidation of cellulose with hypochlorite in absence and in presence of urea leads to identical effects in both cases at pH 11 and 20°c., but bleaching occurs more rapidly with less degradation to the cellulosic chains, as shown by viscosity measurement, during activated oxidation. This is explained on the basis that urea accelerates oxidation of the colouring matter present in cellulose to a greater extent than oxidation of the cellulose itself. G.J.K.

PATENTS

Preparing Cotton for Dyeing or Printing

Deutsche Gold- und Silber-Scheideanstalt vormals Roessler

BP 769,658

Cotton without previous boiling in alkaline solution is quickly and very efficiently prepared for dyeing or printing by bleaching it with an alkali metal chlorite and then treating for a brief period with very dilute, e.g. 0·3–0·5% alkali metal hydroxide or carbonate solution at 80–100°c. C.O.C.

Bleaching During Laundering

Olin Mathieson Chemical Corpn. *USP* 2,733,120

Dry powdered calcium hypochlorite can be added directly to wash liquors containing 100–200 p.p.m. of soap without causing more than slight and even deposition of lime soaps on the articles being washed. C.O.C.

Treating Polyamide Fibres with per-Compounds

Deutsche Gold- und Silber-Scheideanstalt vormals Roessler

BP 767,025

Loss in strength is avoided by carrying out the treatment in presence of an organic nitrogenous compound or salt thereof. It should contain at least one primary or secondary amino group and an >NH group forming part of a saturated ring and at least another such group or an *N*-carboxyamido or sulphonamido group, e.g. ethylenediamine, hexamethylenediamine, *N*-carboxyethylenediamine, piperazine, *NN'*-dimethyl-*p*-phenylenediamine, *NN*-dimethyl-*p*-phenylenediamine, *p*-aminobenzenesulphonamide, and *NN'*-diphenylenediamine. C.O.C.

Chemical Modifications of the Surface Layer of Wool and their Effect on Wettability and Sorption Properties (VI p. 344)

Pretreatments which affect the Susceptibility of Wool to Proteolysis. I— Effects of pH, Wetting Agents, and Solvent Extraction (VI p. 344)

Degradation of Wool by Hypochlorites with special reference to the Action of Hypochlorites on Chemically Modified Wool (X p. 351)

VIII— DYEING

Adsorption of Azoic Coupling Components by Cotton

P. V. Morÿganov and B. N. Mel'nikov

Tekstil. prom., **17**, 41–43 (Feb. 1957)

The mechanism of the adsorption of azoic coupling components based upon the thermodynamic approach of Marshall and Peters (*J.S.D.C.*, **63**, 446 (1947)) is studied. It is found that their affinity for cellulose is independent of the initial coupler and electrolyte concentrations in the dyebath, and that the mode of attachment occurs through hydrogen and van der Waals bonding. The stability of the insoluble hydroxyazo dye, obtained on the fibre after coupling, depends upon the affinity of coupling components for the fibre and upon the physical state of aggregation of the dye on the fibre. A series of coupling components in decreasing order of substantivity, with special reference to printing, is given. G.J.K.

Relation between the Affinity of Direct Dyes and their Chemical Structure

P. V. Morÿganov and B. N. Mel'nikov

Colloid J. U.S.S.R., **19**, 100–103 (Jan.–Feb. 1957)

Using the approach of Marshall and Peters (*J.S.D.C.*, **63**, 446 (1947)) the calculated affinities of six direct dyes for cellulose are compared with the corresponding experimental values. Two main effects are studied— (i) changes in the chain length of the conjugated system, and (ii) benzoylation of amino groups present in the dye. G.J.K.

Interaction of Cellulose with Simple Salt Solutions and with Dyebaths

M. Moncrieff-Yeates and H. J. White

Amer. Dyestuff Rep., **46**, P 87–P 96 (11 Feb. 1957)

Using single filaments of viscose rayon in solutions of the radioactive salts $Na^{82}Br$, $^{22}Na_2SO_4$, and $Na_2{}^{35}SO_4$ the following measurements were made with a radioactive technique which is fully described— variation in equilibrium uptake of Na^+ and SO_4^{2-} with concn. of salt solutions at 25°c. and 90°c.; variations in equilibrium uptake of these ions at 90°c. when the solution contains dye molecules (the absorption of dye was measured by conventional methods); variation in equilibrium uptake of Br^- from NaBr solutions at 25°c. with NaBr concn.; rates of uptake of SO_4^{2-}, Na^+, and Br^- from salt solutions; the effect of the dye : salt ratio on the equilibrium uptake of SO_4^{2-} from Na_2SO_4 solutions containing Chrysophenine G (C.I. Direct Yellow 12), and the effect of the dye : salt ratio on the dye uptake from these solutions, all at 90°c.

The results obtained for the absorption of ions in the absence of dye can be explained satisfactorily by a mechanism of absorption which considers the salt dissolved in water in pores in the fibre in equilibrium with the salt solution surrounding the fibre. As well as the volume of the pores and the concentration of the external salt solution, the cation-exchange capacity is involved in determining the amount of an ion absorbed. In the presence of dye, this theory is inadequate, and the authors suggest that the activity coefficient of the dye anions is altered by strong repulsions when they are absorbed by the fibre.

A statistical analysis of results shows that differences in salt absorption at different dye : salt ratios lie, in the main, within the limits of an experimental error. It is probable, though, that the amount of salt taken up from a solution is lowered by the presence of dye, and that the amount of salt taken up from a solution of a given salt concn. decreases if the dye : salt ratio is increased.

Values of 0·031 mE/g. for unstabilised viscose rayon and 0·039 mE/g. for the stabilised form for the exchangeable cations were calculated from the results, and these agree with determinations by other methods. A diffusion coefficient of approx. 1×10^{-8}cm.^{2}/sec. was found; and no evidence was found for any heat change when the ions were absorbed. P.T.S.

Formation of Oxidation Dyes on Cotton

V. E. Rostovtsev

Tekstil. prom., **17**, 37–39 (Feb. 1957)

The chloramine method for oxidising dyes on the fabric is successfully applied in printing to aniline black, *p*-phenylenediamine (in presence of $CuSO_4$), and some vat dyes, yielding dyeings which are very fast to washing and fairly fast to light and rubbing. Soaking the fabric with chloramine and subsequent drying does not damage the fabric. The photochemical decomposition of chloramine is mentioned. G.J.K.

Estimation of Dyebath Additions for Vat Dyes on Unmercerised Cotton

E. Schneider

Textil Praxis, **12**, 270–276 (March 1957)

The fixation of IW and IN Indanthren (BASF) vat dyes is considered under the following headings— time of dyeing, dyeing temp., dye concn., liquor ratio, degree of penetration, electrolyte concn., and auxiliary products with retarding properties. Tables are given to assist in calculating the relationship between the wt. of material to be dyed, liquor ratio, and depth of colour required. B.K.

Developments in Continuous Dyeing with Vat Dyes — I
H. Waibel
Textil Praxis, **12**, 280–283 (March 1957)
A review of recent developments including the advantages of the use of finely dispersed vat dye powders and the vat-pad and vat-acid continuous processes. B.K.

Internal Application of Colour in the Manufacture of Man-made Fibres
E. I. Birnbaum, C. E. Coke, J. Dean, L. E. Moody, L. J. Sheps, and B. F. Vowles
Canadian Textile J., **73**, 69–78 (14 Dec. 1956): *Amer. Dyestuff Rep.*, **46**, P 125–P 130 (25 Feb. 1957)
In spun-dyed man-made fibres the dye or pigment is incorporated in the "dope" before extrusion. Black spun-dyed nylon and Orlon are available. Spun-dyed dynel, Saran, and polyethylene fibres are available in several colours. Dacron is available only in its natural colour. The conditions for a good pigment for spin-dyeing are connected with particle size, shape, and colour value, its effect on the lustre, strength, abrasion-resistance, etc. of the fibre, and also its fastness to light, perspiration, sea-water, dry-cleaning, etc. Pigment can be incorporated at three stages in fibre manufacture (all before extrusion) and the advantages of each are discussed. The results of light fastness tests are given, and show an enormous improvement over conventional dyeing methods. This points to uses in the car industry, and for sports wear, furnishings, and awnings. P.T.S.

Sulphur Dyes
J. L. Crist and R. E. Rupp
Amer. Dyestuff Rep., **46**, P 83–P 86 (11 Feb. 1957)
Properties of sulphur dyes, difficulties in their use, and suggestions for overcoming them are discussed. Thus tendering caused by the decomposition of sulphur dyes can be inhibited by certain amines; uneven package dyeing can be overcome to some extent by dyeing at a lower temperature, so that the rate of exhaustion is lower—retarders such as ligninsulphonates have the same beneficial effect; dark selvedges due to preferential air-oxidation at the edges is overcome by using a reducing atmosphere and slower dyeing. High rates of exhaustion make continuous dyeing difficult but not impossible; sulphur and sulphur compounds etch copper printing plates, but printing with water-in-oil emulsions has been used, and chromium-plated rollers are not attacked. New quinoneimine dyes with superior fastness to chlorine, light, and washing will soon be in commercial production. P.T.S.

Dyeing of Cotton with Sulphur Dyes in Circulatory Machines
A. I. Avdeev
Tekstil. prom., **17**, 39–41 (Feb. 1957)
Loose cotton and cotton waste are dyed in circulatory machines using Sulphur Blue Z and Sulphur Black (C.I. Sulphur Black 1). Three methods for the preparation of the mother liquor and means of eliminating foam formation and bronziness are mentioned. G.J.K.

Sulphur Dyes. XXXIII— Dyeing Cellulose Acetate with Sulphur Dyes
S. Wakimoto, Y. Hamasaki, and H. Hiyama
Science and Ind. (Japan), **30**, 263–266 (1956): *Chem. Abs.*, **51**, 5425 (10 April 1957)
Cellulose acetate rayon (Cellestron) did not suffer in strength when dyed in medium depths with the sulphur vat dyes Yellow G, Red Brown 6R and Blue TFB from a bath containing Na_2S and NaHS. Deeper dyeings were obtained by using ten solubilised sulphur dyes (Orange OA, Cutch O, Brown D and DNN, Brilliant Blue CLT and BO, Blue BB and F5R, Pure Blue, and Green 5R) which had been neutralised with acid, diluted ten times with ethanolamine using NaHS, $NH_4H_2PO_4$ and $(CH_3)_2C_6H_3SO_3Na$ in the bath which was kept at pH 7·0–7·8. C.O.C.

Relation between Structure of Disperse Dyes and their Dyeing Characteristics on Synthetic Fibres
N. Kuroki and K. Konishi
Bull. Univ. Osaka Prefect., Ser. A, **4**, 123–138 (1956): *Chem. Abs.*, **51**, 4714 (25 March 1957)
A series of 116 disperse azo, nitrodiphenylamine, and aminoanthraquinone dyes was prepared, and examined for dyeability on acetate, vinylon, and nylon. The presence of a suitable hydrophilic group, and a balance of hydrophilic-hydrophobic properties were found desirable. Polar as well as non-polar forces played a part in dye-fibre attachment. E.S.

Change in Diameter of Wool Fibres on Dyeing
P. Larose
Proc. International Wool Textile Research Conf. Australia, **B**, B 114–B 119, B 288 (1955)
There is an increase in the diameter of wool fibres on dyeing with an acid dye such as Orange II (C.I. Acid Orange 7). The volume of the fibre increases linearly with dye content, and it appears that the increase is equal to the volume of the dye added. When the dye content is low, as in many commercial dyeings, the change in fibre diameter is small, and it can be neglected for most purposes. P.G.M.

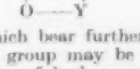
Competitive Inhibition of Mammalian Tyrosinase by Phenylalanine and its Relationship to Hair Pigmentation in Phenylketonuria
M. Miyamoto and T. B. Fitzpatrick
Nature, **179**, 199–200 (26 Jan. 1957)

Pigment Dyeing by the Microfix Process
T. Weber
SVF-Fachorgan, **12**, 211–224 (April 1957)
G. Sulzer
Textil-Rund., **12**, 172–179 (April 1957)
The Microfix (Ciba) process is described, and its effects on abrasion resistance and dimensional stability are illustrated. The preparation of the pigments, three binders, padding, dyeing, aftertreatments, printing, and discharging are considered. S.R.C.

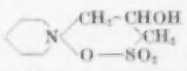
Application of Colorants to Glass-fibre Textiles
R. F. Caroselli
Amer. Dyestuff Rep., **46**, P 195–P 198 (25 March 1957)
Glass fibre can be dyed by the internal application of colour, but such a process is costly, complicated, and industrially inefficient. A more satisfactory way is to bond a pigmented resin to the yarn. If polyvinyl chloride is bonded to the yarn in a 1 : 1 ratio by weight, the result possesses the tensile strength, the chemical resistance, and the dimensional stability of the original glass textile, and the heat, flame, corrosion, and weather resistances are still good. Decorative effects are obtained by alternating layers of clear and coloured polymer on the glass.
Fabrics woven from the polymer-treated glass yarn are heat-set, and are then wrinkle-resistant. Polymer and pigment are padded on to the fabric and cured, and a chrome complex is then padded on to the fabric to bond the pigmented polymer permanently to the glass. This is followed by a second cure. Light fastness, washing fastness, handle, drape, and water-repellency are good. Photographs of tested samples show that the choice of polymer is critical. Glass fabrics are used in the high-quality shoe trade, for insect screens, luggage fabrics, outdoor upholstery, and car seat covers. P.T.S.

PATENTS

Dyeing with Vat Dyes
Cfm *BP* 771,563
In using the vat acid process on the pad use of compounds of formula—



(X = N, S or P which bear further radicals; Y = CO or SO_2; the alkylene group may be hydroxy-substituted), e.g. pyridine-betaine of hydroxypropane sulphopyridine betaine



during vatting and dyeing enables much stronger stock vats to be made, greatly reduces the amount of NaOH necessary and yields level dyeings even with dyes known to be bad levellers. C.O.C.

Increasing the Affinity of Wood for Acid or Basic Dyes
Chadeloid Corpn. *USP* 2,733,119
The wood is treated with an agent which acidifies or oxidises the wood, e.g. aq. sodium hypochlorite or 0·5%

HNO_3, or with an agent which reduces the wood, e.g. sodium hydrosulphide or stannous chloride. Thus unstained walnut is treated for 10 min. with 10% aq. sodium hypochlorite, rinsed with methanol, dried, sanded to a smooth surface and then sprayed with a 4% alcoholic solution of C.I. Basic Green 1. Similar unstained wood is treated for 10 min. with 5% aq. sodium hydrosulphide, rinsed, dried, sanded and then sprayed with a 3% aq. solution of C.I. Acid Yellow 36. In both cases deeper and more even coloration is obtained than would be obtained on untreated wood. C.O.C.

Wool Dyeing with Complex Heavy Metal Compounds of Dyes
Gy *BP* 770,359

Development of *BP* 766,492 (*J.S.D.C.*, **73**, 279 (June 1957)). The wool is heated in a hot liquor containing so much of a strongly dissociating polybasic mineral acid that the final pH of the liquor is 3–6 after which the dye is added and dyeing done in a closed vessel under pressure in absence of polyglycol ethers. Thus worsted cheeses are treated in a Thies machine in an aqueous bath containing H_2SO_4 which is brought to 85°c. by indirect steam in 5–15 min. when the liquid should be at pH 5. The chromium complex of the dye (2 mol. dye to 1 atom Cr) 2-aminophenol-4-ethylsulphoneacetylaminonaphthol-1:7) is added, the apparatus closed, and a static pressure of 3 atm. attained by introducing nitrogen into the expansion chamber, the liquor brought to 100°c. in 10 min., kept at this temperature for 15 min., and dyeing finished by cooling quickly to 90°c. The yarn is very evenly dyed. C.O.C.

Dyeing Polyester Fibres
Ciba *BP* 771,808

Treating the fibres before or during dyeing with disperse dyes with 2-oxydiphenyl in presence of Turkey red oil and an alcohol which is sparingly soluble in water, e.g. benzyl alcohol or pine oil, leads to deep, level dyeings of very good fastness to rubbing. C.O.C.

Sorption of Acids by Wool (VI p. 344)
Water-in-oil Emulsions containing Latex for Improving the Fastness to Rubbing of Coloured Textiles (IX below)

IX—PRINTING

History of the Art of Textile Printing
H. P. Baumann
Amer. Dyestuff Rep., **46**, P 165–P 170, P 180 (11 March 1957)

Xerography
K. A. Metcalfe and R. J. Wright
J. Oil & Col. Chem. Assocn., **39**, 845–856 (Nov. 1956)

Plates and papers are coated with photoconductive films of amorphous selenium on ZnO. The electrostatic images produced on these by light or X-rays are developed with dry powders or with colloidal suspensions in insulating liquids. The images may be transferred for permanent recording and the plates used repeatedly. The advantages of xerography include high resolving power, very rapid controlled development in any chosen colour (and without the need for a dark room or for chemical developing soln.), and low cost. Colour xerography is possible. There are four diagrams, and reproductions of a xerograph and a xeroradiograph. J.W.D.

PATENTS

2-Hydroxy-3-naphthoic-2′:5′-dimethylanilide as Azoic Coupling Component in Textile Printing
ICI *BP* 770,059

The material is padded with an alkaline solution of 2-hydroxy-3-naphthoic-2′:5′-dimethylanilide, printed with a paste containing an aromatic diazonium compound or a stabilised form thereof, and the azoic dye developed. Because of its low substantivity for cellulose this azoic coupling component is readily removed from the unprinted portions of the material so that they are not discoloured. C.O.C.

Water-in-oil Emulsions containing Latex for Improving the Fastness to Rubbing of Coloured Textiles
Interchemical Corpn. *BP* 769,974

The product obtained by dispersing 70–85 parts of butadiene-acrylonitrile copolymer latex into 30–15 parts of a mixture of a volatile water-immiscible hydrocarbon solvent, aralkyd resin, and a hydrocarbon wax is stable and when incorporated into pigmented water-in-lacquer emulsions improve the fastness to rubbing of dyeings or prints made with the emulsions. C.O.C.

Transfer Printing of Textiles
M. Levy *BP* 771,375

The textile fabric is treated with several transfers each of which is a continuous web, under the influence of heat and pressure, e.g. by passing the fabric in contact with the transfers through a nip formed by hot rollers. C.O.C.

Printing on Polyethylene with Drying Oil Inks
Celanese Corpn. of America *BP* 770,576

Polyethylene which has been coated with a mixture of chlorosulphonated polyethylene and cyclised rubber and heated, e.g. for 2–5 min. at 80–90°c. is readily printed with inks based on drying oils. C.O.C.

Printing on Poly(vinyl chloride) Films
S. Pinto *USP* 2,733,180

The print is first made on coated paper and is then coated with a resin compatible with the poly(vinyl chloride). It is then transferred to the film by heat and pressure and the clay or other coating medium of the paper washed away to leave the face of the plastic clean. C.O.C.

Photographic Iron-Silver Colour Process
M. P. L. Martinez *BP* 770,959

A ferric salt, e.g. ferric ammonium oxalate, is deposited on a film, exposed to light through a negative so as to form ferrous ions in the exposed parts, treated with a silver salt to produce a silver image which is in turn replaced with a colour vehicle. Multicoloured photos are obtained by repeated successive applications of this process to the same film. C.O.C.

Dye Formation in Colour Photography (IV p. 335)
Formation of Oxidation Dyes on Cotton (VIII p. 347)

X—SIZING AND FINISHING

Heat and Moisture Relations for Textiles
F. L. Warburton
Proc. International Wool Textile Research Conf. Australia, **D**, D 220–D 233, D 268–D 269 (1955)

The factors that govern the transfer of heat and moisture to and from fabrics are discussed, using a modified wet-bulb theory. The relations derived are used to examine the various factors that contribute to thermal efficiency in the tenter and also the drying of wool in package form. It is shown that, provided a high humidity is maintained in the tenter exhaust, the advantage of drying with superheated steam is much less than is supposed. P.G.M.

Far Infrared for Textile Finishing
W. L. Thomson
Amer. Dyestuff Rep., **46**, P 171–P 175 (11 March 1957)

One advantage of far-infrared radiant heating is that it heats all colours equally: this "colour-blindness" is not shown by near-infrared heating. Other advantages are given. Types of infrared heater available in the U.S.A. are illustrated. Operating details and the economics of operation are given. P.T.S.

Crystallite Orientation in Cellulose Fibres
V. D. Gupta
J. Polymer Sci., **24**, 317–319 (April 1957)

X-Ray studies of rayons show that different dulling agents, such as titanium oxide and oils, do not appreciably affect orientation. In the case of delignified jute the fibre is rendered easy to disorient because of the absence of lignin. W.R.M.

Chemical Modification of Cotton by Reaction with Activated Olefinic Compounds
J. W. Frick, W. A. Reeves, and J. D. Guthrie
Text. Research J., **27**, 92–99 (Feb. 1957)

Compounds containing activated olefinic linkages differ widely in the ease with which they etherify cellulose in a base-catalysed addition reaction. Acrylamide reacts readily, and the resulting carbamoylethyl ether has good fabric properties and modified dyeing characteristics. The cellulose derivatives of maleic, acrylic, and itaconic acids have modified dyeing characteristics and ion-exchange

properties. Of the water-insoluble compounds investigated, crotonaldehyde reacted to give a product containing free aldehyde groups. J.C.F.

Fibrous Cellulose Esters by Trifluoroacetic Anhydride Method
C. Hamalainen, R. H. Wade, and E. M. Buras
Text. Research J., **27**, 168 (Feb. 1957)

The preparation of a range of partial esters of cotton cellulose by reaction with the appropriate acid in trifluoroacetic anhydride–benzene is reported. For 23 organic acids, and using 1 equivalent of acid per anhydroglucose unit, the degree of substitution produced in 24 hr. at 30°c. ranged from 0·02 for phenoxyacetic acid to 1·64 for acetic acid. Trifluoroacetyl groups are not introduced and the products are reported to have good textile properties. J.C.F.

Simplified Relationship between Properties of Resin-finished Cotton Fabric and Solids applied
S. H. Foster
Text. Research J., **27**, 129–135 (Feb. 1957)

In the resin treatment of cotton, it is found that wrinkle recovery, tensile strength, and tear strength vary directly as the logarithm of the resin solids applied. With an amine hydrochloride catalyst, wrinkle recovery at constant resin solids increases directly with the logarithm of the catalyst concentration between approx. limits 0·1–1% on the bath. These relationships have been found useful in predicting the performance of resin-treated cotton. Evidence is presented which suggests that wrinkle recovery is produced by cross-links between pairs of cellobiose units in the accessible regions of the cellulose. J.C.F.

Mechanism of Crease-resistance Development on Cellulosic Fabrics treated with Bishydroxymethylethyleneurea
H. C. Walter, J. K. Buxbaum, and L. Q. Green
Text. Research J., **27**, 146–149 (Feb. 1957)

In the reaction of bishydroxymethylethyleneurea with cellulose, cross-linking of the cellulose chains occurs, probably through the formation of hydroxymethyl ether linkages. This cross-linking is responsible for the improved fabric properties. Polymerisation of the reagent within the fibre does not occur, and the resistance of the finish to laundering is due to the chemical bonding of the reagent to the cellulose. J.C.F.

Epoxy Resins in the Crease-proofing of Cotton
C. W. Schroeder and F. E. Condo
Text. Research J., **27**, 135–145 (Feb. 1957)

Epoxy resins have been shown to give durable crease-resistant finishes on cotton fabrics. Of a range of catalysts investigated, the fluoroborates of Zn, Al, and Mg were found to be most suitable. Data are given for the effect of resin solids take-up and catalyst concentration on crease resistance, tensile strength, and tear strength. The addition of rubber latices and softeners may have a beneficial effect. Epoxy resin finishes are particularly suitable for white goods as they are non-chlorine-retentive and the fabrics may be bleached and ironed repeatedly without loss in strength or scorching. J.C.F.

Comparison of Wrinkle-resistant Finishes for Cotton
T. F. Cooke, P. B. Roth, J. M. Salsbury, G. Switlyk, and W. J. van Loo
Text. Research J., **27**, 150–165 (Feb. 1957)

An extensive and statistically designed study of the application of the following resins to cotton fabric: (*a*) urea–, (*b*) ethyleneurea–, (*c*) melamine–, and (*d*) modified melamine–formaldehyde. The accelerators studied were an ammonium salt, an alkanolamine hydrochloride, and a metallic salt, and the variables were resin concentration, curing temperature, and time of cure. Resin (*b*) gives the highest crease-recovery for a given resin concn., and (*a*) the lowest; (*d*) approaches (*b*) in efficiency under optimum curing conditions. Retention of crease-recovery after chlorine washing is considerably greater for (*c*) and (*d*) than for (*a*) and (*b*). Resins (*a*) and (*c*) give higher tensile strengths for a given degree of crease-recovery than do (*b*) and (*d*). In the AATCC accelerated chlorine test, (*a*) alone shows a very marked drop in tensile strength. Initial yellowing of the treated fabric during curing is greater for (*a*) than for the other resins, whereas (*c*) shows the greatest tendency to yellow during chlorine washing. There is little difference in tear strength for a given degree of crease recovery amongst the four finishes. Of the accelerators, the inorganic metallic salt was superior in all respects, but required a high curing temperature. The alkanolamine hydrochloride gave fabric properties inferior to those given by the metallic salt, but required a lower curing temperature. In general, the ammonium salt gave least improvement in fabric properties. J.C.F.

Effect of Chemical Modification on the Flame and Glow Resistance of Cotton Cellulose
E. Pacsu and R. F. Schwenker
Text. Research J., **27**, 173–175 (Feb. 1957)

The following chemical treatments of cotton cellulose produce fabric with improved flame and glow resistance: (*a*) esterification of the 6-OH group of the anhydroglucose unit with methanesulphonyl chloride (I), followed by partial replacement of the $O{\cdot}SO_2{\cdot}CH_3$ group by bromine or iodine; (*b*) phosphorylation with diethyl chlorophosphate (II); and (*c*) a combination of esterification with I and phosphorylation with II followed by halogen replacement. Preliminary tests indicate that the physical properties of treated fabrics are satisfactory and that the finishes withstand laundering. J.C.F.

Cross-linking Reactions in Keratin
I— Chemical Mechanism of Permanent Set
R. S. Asquith and J. B. Speakman
Proc. International Wool Textile Research Conf. Australia, **C**, C 302–C 307, C 492–C 494 (1955)

It is suggested that if the setting of strained wool fibres in steam or boiling water is due to disulphide-bond breakdown, followed by the formation of sulphenamide cross-linkages, set fibres should contain more thiol and fewer amino groups than untreated fibres. Using model compounds, it has been shown that sulphenamides are decomposed by boiling 6*N*-HCl with formation of the sulphenyl chloride and liberation of the amine. When the reaction is carried out in presence of a thiol, a disulphide is formed by the action of the sulphenyl chloride on the thiol. If set fibres contain sulphenamide cross-linkages, cystine will be regenerated when the fibres are hydrolysed in boiling HCl, and thus the failure of Cuthbertson and Phillips (1945) to find excess cysteine in the hydrolysate may be explained. Similarly, the lysine content of set fibres, as estimated in the hydrolysate, is found to be the same as that of untreated fibres. Before hydrolysis, however, the set fibres contain fewer lysine side-chains, as has been demonstrated by estimating the amount of ε-*N*-dinitrophenyllysine in the hydrolysate of fibres treated with fluorodinitrobenzene after setting, and it is suggested that lysine side-chains take part in cross-linkage formation during setting.

II— Action of Formaldehyde on Wool
H. R. Richards and J. B. Speakman
Ibid., C 308–C 314, C 495–C 497

Ethanolic solutions of iodine convert 96% of the tyrosine side-chains of wool into 3:5-di-iodotyrosine side-chains in 72 hr. at 22·2°c. As formaldehyde-treated wool combines with about the same amount of iodine as untreated wool, it seems unlikely that the tyrosine and lysine side-chains are cross-linked with formaldehyde.

III— Action of Ninhydrin on Wool
R. Cockburn and J. B. Speakman
Ibid., C 315–C 339, C 497–C 499

After being treated with an aqueous solution of ninhydrin, wool fibres are much more resistant to extension in water. The rate of reaction increases with increasing temperature, and a boiling solution of ninhydrin gives maximum strengthening at pH 4–7. Fibres pretreated with F.D.N.B. are strengthened to a less extent than untreated fibres, and since fully desaminated fibres are incapable of being strengthened by ninhydrin, it is suggested that the basic side-chains of lysine and arginine may play a fundamental part in the reaction. Some small strengthening may come from the action of ninhydrin on the terminal amino groups of the polypeptide chains, and the possibility of reaction with amide side-chains is not excluded. Model experiments with methylguanidine and acetamide have shown that ninhydrin does not combine with more than 1 molecule of either reagent. The greatest observed increase in wt. of wool through reaction with ninhydrin is 15·9%, reaction with amide side-chains

seems to be excluded, but reaction with arginine side-chains can lead to strengthening if there is hydrogen bonding between the keto groups in the 1- and 3-positions of the combined ninhydrin and the hydroxy, phenolic, and peptide groups of the fibre. Strengthening is not due to this cause alone, for it is found that it is always associated with development of a purple colour on the fibres, and treatments which result in loss of strength cause a marked change of colour.

IV—Action of Ninhydrin on Reduced Wool Fibres

R. Cockburn and J. B. Speakman

Ibid., C 340–C 349, C 497–C 499

Thiophenol and thioglycollic acid are converted into the corresponding disulphides by reaction with a boiling solution of ninhydrin. Similarly, when wool fibres which have been reduced with thioglycollic acid are treated with a boiling solution of ninhydrin, cystine cross-linkages are re-formed. In addition, the fibres are further strengthened by the action of ninhydrin on basic side-chains, just as in the case of untreated fibres.

V—New Method of Setting Strained Fibres at Low Temperatures

P. T. Speakman and J. B. Speakman

Ibid., C 350–C 354, C 497–C 499

It has been found that strained fibres can be given a high degree of permanent set by treatment with a mixture of Na_2SO_3 and ninhydrin at 50°c., presumably because ninhydrin reacts more rapidly with cysteine side-chains than with Na_2SO_3. The method is specially interesting in being the first example of setting by means of a mixture of an oxidising and a reducing agent. P.G.M.

Cross-linking Reactions with Amino Acids and Fibrous Proteins

H. Zahn

Proc. International Wool Textile Research Conf. Australia, **C**, C 425–C 451 (1955)

Bifunctional molecules, which react with amino acid residues in fibrous proteins, may be used in the determination of the structure of these proteins, provided the bonds so formed are stable to hydrolysis and the cross-linked amino acids can be isolated from the reaction mixtures. Identification of the amino acids thus linked enables some deductions to be made about the spatial arrangement of the amino acids in the original peptide chain. *OO'*-polymethylenebistyrosine ethers, various *NN'*-polymethylenebisamino acids and *SS'*-polymethylenebiscysteines were prepared. The reaction products of bifunctional aromatic fluoro-compounds with amino acids were more closely examined, as these yield derivatives with aniline and phenol which are stable to hydrolysis. 1:5-difluoro-2:4-dinitrobenzene (FFDNB) exchanges either one or two fluorine atoms for the residue of one, two similar, or two different amino acids, and the same is true for 4:4'-difluoro-3:3'-dinitrodiphenyl sulphone (FF sulphone). The synthetic bridged amino acid pairs have been characterised by analysis, m.p., X-ray diagrams and R_f values. Silk fibroin, wool keratin, and tendon collagen have been treated with hexamethylene diazide, polymethylene bromides, FFDNB, and FF sulphone. From these have been isolated the diethers of tyrosine, bisthioethers of cysteine, and dinitrophenylenebistyrosine, dinitrophenylenebislysine, and dinitrophenylene-lysine-tyrosine as well as bistyrosine sulphone, bislysine sulphone, bishydroxylysine sulphone, and lysinehydroxylysine sulphone. In cases where the cross-linking agents react bifunctionally with the above fibrous proteins, it can be deduced that lysine, hydroxylysine, and tyrosine are grouped in certain segments of the protein, the resulting increased chemical stability shows that the amino acids of neighbouring chains become cross-linked with each other. P.G.M.

Chemical Modification of Wool by Formalisation with Hexamethylenetetramine

M. Oku and I. Shimizu

Proc. International Wool Textile Research Conf. Australia, **C**, C 286–C 293, C 491 (1955)

Active formaldehyde liberated from acidic solutions of hexamethylenetetramine (HMTA) has been used as an effective formalising reagent to improve the native properties of wool. The best conditions of treatment were found to be treatment of the wool for 40 min. at 90°c. with a 0·6–1·0% aqueous solution of HMTA acidified with acetic acid in 150% excess over the theoretical amount at a liquor ratio 100 : 1. Under these conditions, alkali solubility, dissolution velocity in 15% KOH, shrinkage control, and elastic recovery of wool are improved remarkably but resistance to acidic solutions is not improved to the same degree. The cause of this modification may be the formation of many new methylene cross-linkages between the polypeptide chains of keratin molecules. P.G.M.

Degradation of Wool by Hypochlorites with special reference to the Action of Hypochlorites on Chemically Modified Wool

R. Bentham, C. B. Stevens, and C. S. Whewell

Proc. International Wool Textile Research Conf. Australia, **C**, C 277–C 285, C 490–C 491 (1955)

The degradation produced by the action of hypochlorites on wool modified by alkalis, acids, deaminating agents and dyes (acid, mordant, and leuco vat) is assessed by measuring the reduction in work required to stretch fibres after the various treatments. In general, the nature as well as the extent of any initial modification determines the degradation produced during a particular chlorination treatment. Stabilisation of –S·S– linkings by treatment with KCN increases the resistance of the fibres to attack by hypochlorites as does pretreatment with fluorodinitrobenzene. Treatments with hot alkalis and with HNO_2 make the fibres more susceptible to degradation by hypochlorites. Wool dyed with normal amounts of acid or mordant dyes is degraded by chlorination to the same extent as untreated wool, but wool dyed with 40% Solway Blue B8 shows an improved resistance. Fibres dyed with leuco vat dyes are not markedly susceptible to attack when chlorinated in presence of white wool, but untreated wool is more degraded when chlorinated in presence of a pattern of cloth dyed with leuco Cibanone Orange R than in the presence of white wool, possibly owing to the formation of free radicals during the oxidation of the leuco vat dye by the hypochlorite. P.G.M.

Dimaleimides as Cross-linking Agents for Reduced Wool

J. E. Moore and H. P. Lundgren

Proc. International Wool Textile Research Conf. Australia, **C**, C 355–C 362, C 499–C 500 (1955)

Evidence is presented that *o*- and *m*-phenylenedimaleimides are effective cross-linking agents for reduced wool. These compounds are easily prepared and react by direct addition to the available thiol groups. The treated wools are protected from supercontraction in hot reducing media and exhibit lowered solubilities in acid and alkali and are resistant to oxidation by peracetic acid. The modified cystine of hydrolysates of the treated wools has been identified chromatographically. P.G.M.

PATENTS

Permanent Mechanical Effects

Heberlein & Co. *BP* 770,082

Cotton cloth, particularly lightweight cloth, is shrunk with aq. alkali hydroxide, e.g. 22–30° Bé. NaOH, then impregnated with a thermosetting resin, treated mechanically and then baked. This gives a permanent finish without impairing the mechanical strength of the cloth. The treatment with alkali may take place at any desired stage of treatment preceding the resin impregnation, e.g. either the grey, the kier boiled or the bleached cloth may be treated. C.O.C.

Reducing the Felting Power of Wool

Wolsey *BP* 771,811

Material wholly or partly of wool is treated with ≯ 1% (on wt. of wool) of permonosulphuric acid, then with ≯ 3% of water-soluble permanganate and then with a reducing agent. C.O.C.

Imparting Microbicidal Properties to Textiles, Rubber, Paper, Leather, Plastics, Ceramics, etc.

Permachem Corpn. *BP* 769,799

The materials are coated by co-precipitating into them a sparingly-soluble silver salt and a sparingly water-soluble compound of another metal which stabilises the silver salt to light. Thus cotton sheeting was first treated with an aqueous solution of silver nitrate and hydrated magnesium nitrate and then with an aqueous solution of sodium chloride, disodium hydrogen phosphate and ammonia. Finally it was squeezed, dried, washed in clear water to remove soluble salts and dried. The handle and

colour of the treated fabric were indistinguishable from those of the untreated fabric. It was not discoloured after 60 days' exposure to sunlight and was both antiseptic and self-sterilising. C.O.C.

Embossed Pile Fabric
Mohasco Industries *BP* 769,760

A woven or sewn tufted fabric has a finely divided thermoplastic material distributed throughout its pile and is then embossed so that the thermoplastic material in the depressed areas is rendered adhesive, after which that in the other areas is removed, e.g. by agitation and suction. C.O.C.

Rubberised Cloth, etc.
Etablissements Pennel & Flipo *BP* 771,324

Cloth or the like is coated with a rubber composition having an elongation before rupture of $< 250\%$ and containing an agent which liberates gas when heated, e.g. dinitrosopentamethylene tetramine, the amount of this agent being such that the gas liberated causes 30–80% by volume expansion of the composition. The product is impermeable to water but permeable to gases. C.O.C.

Coating Fabric with Rubber or Thermoplastic Resin
Galon *BP* 771,836

The fabric to be coated is freed from tension by uniting it to a less elastic base while it is being coated, dried and cured, e.g. by glueing it to strong paper. The process is particularly applicable to knitted fabric. C.O.C.

Extension, Contraction, and Supercontraction of Wool Fibres (VI p. 343)
Rendering Regenerated Cellulose Fibres Uniformly Dyeable with Direct Dyes (VI p. 346)

XI—PAPER AND OTHER CELLULOSIC PRODUCTS

Composition of the Short-fibre Fraction of Cellulose
S. L. Talmud, A. N. Turzhetskaya, and A. A. Kuleshova
Colloid J. U.S.S.R., **19**, 118–120 (Jan.–Feb. 1957)

The short-fibre fraction, isolated from cellulosic waste in papermaking, contains a high proportion of waxes, fats, and lignin, and only 72·3% cellulose (on the wt. of the bone-dry material). Elimination of the short-fibre fraction is recommended as a means of improving the quality of cellulose. G.J.K.

Optical Properties of Cellophane
S. N. Gaythorpe
Nature, **179**, 322 (9 Feb. 1957)

The author refers to the earlier communication of E. F. Fahy and M. A. MacConaill (cf. J.S.D.C., **73**, 117 (March 1957)). Styrafoil (BX Plastics Ltd.) in double thickness acts also as a half-wave retardation plate. The material is birefringent and gives refractive indices of 1·588 and 1·594. The "half-mil" quality causes a retardation of one-eighth of a wave of Na light, and it can be used to build up a polarisation step-wedge which provides an efficient and cheap replacement for the usual quartz or selenite wedge used in polarisation microscopy. The strips used for this purpose must be cut for the same area of the sheet. In the case of Styrafoil the colour in polarised light is a thickness and not a surface property. J.W.D.

Optical Observations during Dissolution and Precipitation of Cellulose. I and II
H. Dolmetsch
Papier (*Darmstadt*), **11**, 52–58 and 145–152 (1957)

During slow dissolution of native cellulose fibres, disintegration into periodically transversely divided and occasionally cross-linked fibrils can be observed under the microscope. On fractional precipitation, similar strands are again observed, the length of which depends on the viscosity of the solution. In order to examine the possible identity of both structural elements and to obtain information on the state of dissolution of cellulose, linter fibres isolated under mild conditions were dissolved in an iron-tartaric acid complex solution to a high degree of dilution and then regenerated in such a way as to avoid disordered agglomeration. The results of electron-microscopical investigation were compared with published data on similar fibres that had been disintegrated without swelling. The same characteristic features were found for both native and regenerated strands. Typical changes were observed, however, that have a definite bearing on the behaviour of fibres in the swollen state and may help to explain the earlier photomicrographs.

Electron-microscopic studies of cellulose precipitated from highly dilute solutions have shown that fibrils (i.e. microfibril bundles) may become stretched in the swollen state and, as a result, part of the fibril is constricted. This behaviour explains the microphotographs of dried high polymer cellulose nitrate solutions. With increasing degradation, this type of mechanical deformation results in defibration and breaking up of the loosened regions leading to the formation of free microfibrils of varying magnitudes, whereas the more resistant parts of the fibril lying between the loosened regions are preserved in the form of elliptical knots. Regeneration of different cellulose preparations from highly dilute solutions in heteropolar solvents allows further characteristics of the microfibrils to be studied. The correspondence of these microfibrils to structural elements of other natural substances is discussed. K.W.

Problem of Mercerisation—I
E. Treiber
Papier (*Darmstadt*), **11**, 133–139 (1957)

Factors affecting the reproducibility of filtration values: sampling, viscose preparation and, in particular, the effect of the filter material, and some problems of the laboratory method for preparing alkali cellulose, with special reference to a new apparatus based on the slurry mercerisation process, are discussed. K.W.

Alkaline Degradation of Cellulose
G. Machell, G. N. Richards, and H. H. Sephton
Chem. and Ind., 467–469 (13 April 1957)

Degradation of cotton hydrocellulose has been carried out in boiling 0·5 N-NaOH in absence of oxygen. The products of degradation are tabulated. Cellulose, treated with hot sodium hydroxide solution in absence of oxygen ultimately becomes stable to alkali. The alkali-stable group corresponding to the "stopping reaction" has been isolated and identified as a mixture of α- and β-D-gluco-metasaccharinic acids. A scheme representing the probable course of reactions in degradation is given. The degradation reactions represent a progressive stepwise degradation from the reducing end of the molecule. The stopping reaction competes with this but occurs at a much slower overall rate. W.R.M.

Carboxy and Carbonyl Groups in Cellulose degraded by Ageing of Alkali Cellulose
F. Alräng and O. Samuelson
Svensk Papperstidning, **60**, 31–36 (31 Jan. 1957)

Purified cotton was mercerised and degraded by ageing in air or by addition of H_2O_2 during mercerisation. The carboxyl contents were determined according to the alkalimetric method of Samuelson and Wennerblom, the treatment time in alk. salt solution being shortened to 3–5 hr. to prevent interference of the carbonyl groups, and correlated with $(D.P.)_n$ measured osmotically. An average of 1·10 and 1·30 carboxyl/mol. of cellulose aged in air at 25°C. and 45°C. respectively was obtained; degradation with H_2O_2 reduced the carboxyl content to < 1. The carbonyl content determined by means of a modified Geiger and Wissler method was higher for cellulose degraded with H_2O_2 than for cellulose aged in air. K.W.

Regenerated Structural Elements from Highly Dilute Cellulose Solutions
H. Dolmetsch
Svensk Papperstidning, **60**, 50–55 (31 Jan. 1957)

The author discusses objections raised by Frey-Wyssling and Meier (*ibid.*, **59**, 501–502 (31 July 1956)) to his theory that native cellulose elements are preserved in highly dilute solutions. He maintains that the structures, i.e. knots and strands, shown in photomicrographs and electron photomicrographs of dried highly dilute cellulose solutions are in fact fibrils and that their diameters agree with published data of native fibrils, and that they are not agglomerations of low-polymer cellulose molecules and short-chain hemicelluloses as suggested by F.-W. and M. The author expresses the belief that a relation will be found eventually between the shape of the fibre fragments isolated from cellulose solutions and their viscosity behaviour in solution in accordance with Staudinger's theory. K.W.

Relations between the Chemical Composition of Alkali Cellulose and the Kinetics of Fibre Xanthation
B. Philipp
Svensk Papperstidning, **60**, 88–91 (15 Feb. 1957)
The influence of composition and structure of alkali cellulose on the reaction kinetics has been investigated by gas analysis of the xanthates prepared with excess CS_2, and the data obtained have been evaluated in accordance with the reaction mechanism Na-cellulose I → xanthate → cellulose II. The change in the maximum γ value with steeping-lye concentration agreed closely with the amount of chemically bound NaOH (Schwartzkopf method). The steep decrease in the velocity constants on passing the mercerisation limit together with X-ray data obtained indicate a much higher rate of xanthation of the amorphous regions as compared with the crystalline regions.
K.W.

Kinetics of Fibrous Acetylation of Cotton and Jute
M. K. Sen and M. Ramaswamy
J. Textile Inst., **48**, T 75–T 80 (March 1957)
Rates of diffusion into cotton and jute have been followed by observing rates of acetylation, where diffusion is the rate-controlling process. Qualitative comparison of the rates of acetylation of the two fibres in swelling (glacial acetic acid) and non-swelling (benzene) media suggests that in cotton diffusion is controlled by a "place-exchange" mechanism, in which diffusion causes a rearrangement of the cellulose molecules, whereas in jute diffusion takes place on vacant sites on the molecules. Diffusion into cotton is through a skin. The conclusions are supported by the apparent activation energies calculated for the range 25–30°C. at 25% acetyl regain; cotton 17 kcal./mole, jute 13 kcal./mole. In cotton the rate of acetylation is, as expected, dependent to a greater extent on the initial moisture content of the sample. With jute the concentration of acetylating agent has a more marked effect on the rate of acetylation than with cotton.
P.T.S.

Heterogeneous Acetylation of Cellulose Films
T. Fujimura
Bull. Chem. Soc. Japan, **29**, 550–553 (July 1956)
A pad of several thicknesses of cellulose sheet was treated from one side only with an acetylating mixture of acetic anhydride, benzene, and "acetylsulphuric" acid. The extent of acetylation through the pad is determined by dyeing the layers with a mixture of direct and disperse dyes. The results agree with the theoretical equation for a diffusion-controlled process. The number of acetylated layers at time t is proportional to $t^{0.5}$; the rate of passage of acetylation from layer to layer increases with increasing concn. of acetic anhydride; conc. of "acetyl-sulphuric" acid, the pressure of solution above the pad, and the temp. have little influence; preswelling in acetic acid has a considerable influence.
A.J.

Ethylhydroxyethylcellulose
I. Croon and B. Lindberg
Svensk Papperstidning, **60**, 82–84 (15 Feb. 1957)
The cellulose ether was hydrolysed to monomers, which were then fractionated. Glucose, five monosubstituted and three disubstituted ethers were isolated and characterised.
K.W.

Water-soluble Ethylhydroxyethylcellulose
I. Jullander
Ind. Eng. Chem., **49**, 364–368 (March 1957, Pt. I)
Ethylhydroxyethylcellulose, prepared by coetherification of cellulose with ethyl chloride and ethylene oxide, has much better solubility in water than ethylcellulose, and its general properties are similar to those of methylcellulose. It has been produced commercially in Sweden since 1945. The method of manufacture is outlined, and analytical problems are discussed. Its physicochemical properties, particularly those in which it differs from methylcellulose, are described.
W.K.R.

Ion Exchange on Dicarboxycellulose
V. I. Ivanov, N. Ya. Lenshina, and V. S. Ivanova
Izvestiya Akad. Nauk S.S.S.R. otdel khim. nauk, 118–119 (Jan. 1957)
2:3-Dicarboxycellulose obtained through oxidation of cellulose with $NaIO_4$ and $NaClO_2$ is claimed to show chelating properties for metallic cations. In the case of Ni^{2+} and Fe^{3+} quantitative desorption is achieved with 0·1 *N*- and 5 *N*-HCl respectively. Its application to a selective separation of cations is suggested. It is a better adsorbent for cations than 6-monocarboxycellulose.
G.J.K.

Transfer Coating Compositions for Carbon Papers (V p. 340)
Rheological Behaviour of Hydrogen-bonded Solids. I—Primary Considerations (VI p. 341)
Further Evidence for the Existence of Three Different Free Hydroxyl Groups in Acetone-soluble Cellulose Acetate (VI p. 341)
Imparting Microbicidal Properties to Textiles, Rubber, Paper, Leather, Plastics, Ceramics, etc. (X p. 351)

XII—LEATHER; FURS; OTHER PROTEIN MATERIALS

X-Ray Diffraction Patterns and α → β Transformation of a Protein extracted from the Human Epidermis
D. A. Roe and A. N. J. Heyn
Nature, **179**, 266–267 (2 Feb. 1957)
A fibrous protein has been extracted from the cellular portion of human epidermis with 75% LiBr. X-Ray diagrams of (*a*) the unoriented protein, (*b*) a specimen oriented by the extension method of Rudall (*Proc. Royal Soc.*, **B**, **141**, 39 (1953)), and (*c*) a specimen oriented and then extended 90% after immersion in saturated $(NH_4)_2SO_4$ soln. at 90°C. for 2 min., are reproduced and discussed. The similarity of the X-ray diagram of the oriented sample to that of regenerated α-keratin, the α→β transformation upon stretching under suitable conditions ((*c*) above), and supercontraction experiments (also described) support the theory that this is a keratinous protein. It is probably an incompletely cross-linked precursor of keratin, and may be related to "epidermin" and "α-keratose".
J.W.D.

Composition of Epidermis
J. H. Bowes and R. G. Elliott
J. Soc. Leather Trades Chem., **41**, 87–93 (March 1957)
Epidermis differs markedly from normal keratins in its amino-acid composition. As with the hard proteins, the methionine and glycine content is higher, but the lysine, aspartic acid, and histidine contents are higher, and the proline, threonine, valine, and arginine contents are lower than those of the hard proteins. The low proportion of disulphide bonds, compared with that in wool and hair, probably accounts for the much greater swelling and solubility of epidermis. For these reasons epidermis is preferentially dissolved during the pre-tanning processes; the action of alkalis and of sulphide in the unhairing of skins is explained in these terms.
J.W.D.

Structure of Collagen Fibres
S. G. Tomlin
Proc. International Wool Textile Research Conf. Australia, **B**, B 187–B 192, B 295–B 296 (1955)
A long thin cylindrical particle about 12 A. in diameter and about 2,900 A. in length has been found to be a satisfactory unit with which to construct a model of the collagen fibre consistent with the observations of electron microscopy and X-ray diffraction studies. The model also allows an explanation of the occurrence of both large- and small-period collagen fibres.
P.G.M.

Native and Precipitated Collagen
J. T. Randall, F. Booth, R. E. Burge, S. F. Jackson, and F. C. Kelly
Symposia Soc. Exptl. Biol., No. 9 (1954), "Fibrous Proteins and their Biological Significance" 127–147 (1955)

Configuration of Collagen and Gelatin Molecules in Condensed and Dispersed States
R. S. Bear
Symposia Soc. Exptl. Biol., No. 9 (1954), "Fibrous Proteins and their Biological Significance" 97–114 (1955)

States of Aggregation of Collagen
F. O. Schmitt, J. Gross, and J. H. Highberger
Symposia Soc. Exptl. Biol., No. 9 (1954), "Fibrous Proteins and their Biological Significance" 148–162 (1955)

X-Ray Diffraction Studies of Collagen Fibres

P. M. Cowan, A. C. T. North, and J. T. Randall

Symposia Soc. Exptl. Biol., No. 9 (1954), "Fibrous Proteins and their Biological Significance" 115–126 (1955)

Sequence of Amino Acids in Collagen. I— Position of Proline and Hydroxyproline

W. Grassmann, K. Hannig, H. Endres, and A. Riedel

Hoppe-Seylers Z. physiol. Chem., **306**, 123–131 (1956): *Chem. Abs.*, **51**, 5142 (10 April 1957)

Collagen and procollagen were cleaved by crystalline trypsin to yield a number of peptides some of which were long chain products. The homogeneity of the peptides was investigated electrophoretically and chromatographically and by analysis of the amino acid contents. The proline- and hydroxyproline-rich peptides did not contain many diamino and dicarboxylic acids whereas the proline- and hydroxyproline-deficient peptides were rich in such acids. Study of a peptide made up of 42–44 amino acid showed that the terminal amino groups came exclusively from glycine and the terminal carboxy groups from aspartic acid. About one-third of the amino acids were glycine, another third proline and hydroxyproline, and the remaining third other amino acids. C.O.C.

Vegetable Tannage of Sheepskins: Systematic Study of various Factors in the Tanning Process. II— Chemical Analyses, Manual Assessments, and Darkening of Leathers on Exposure to Light

M. F. Chambers, R. G. Mitton, and E. F. Nattrass

J. Soc. Leather Trades Chem., **41**, 48–59 (Feb. 1957)

Chemical analyses and manual assessments have been made on vegetable-tanned sheepskins, the treatment of which had been systematically varied (*ibid.*, **41**, 7 (Jan. 1957)). The extents to which the leathers darkened during exposure (to a Hanovia 5008 lamp) have also been assessed. The results of the analyses and assessments are described. Higher degrees of tannage were obtained with mimosa than with chestnut liquors, and by the use of liquors with higher tan content. Degree of tannage varied in a complex manner with the acid and salt content of the tan liquors. The max. fullness and firmness was obtained with liquors of low pH and low salt content, but at the expense of a greater tendency to drawn grain, particularly when the tan contents of the liquors were high. These factors have also a complex effect on the initial colour of the tanned leather, and on its stability to light-exposure. If a leather is required whose shade remains relatively constant during exposure, it may be obtained with a chestnut tannage of low pH and salt content, or by tanning at pH 5 with about 5% salt, but the colour is then dark initially. J.W.D.

Influence of the Duration of Pickling and Methods of Chrome Tanning on the Properties of Chrome Side Leather

M. F. Chambers, R. G. Mitton, and E. F. Nattrass

J. Soc. Leather Trades Chem., **41**, 60–69 (Feb. 1957)

Chrome side leathers were made by the use of a very short or a long pickle, by tanning with chrome liquors of various basicities, by adding all the chrome at the beginning of tannage or by adding only half then and the rest later, and were dyed with two different types of dye (acid and direct). The grease and chrome contents were determined, and measurements made of area, thickness, density, resistance to compression, buckle-tear strength, dye penetration, and colour fastness to rubbing. The oil-uptake from fat-liquor and the distribution of fat through the leather were greatly influenced by the dye used, but there was no conclusive evidence or information regarding the amounts of dye fixed or the depths of dye penetration. Chrome fixation is increased if tannage is begun in liquors of higher basicity, and the increases are greater if a very short pickle is used rather than a very long one; even so, the short pickle gave much reduced substance at each of the basicities employed, and it may be that the quantity of pickle acid is critically related to the state of the bated pelt. The lower substance with the short pickle was partly, but not wholly, compensated by greater area yield. Density, buckle-tear strength, and resistance to compression were not greatly influenced by any of the factors varied in the work. J.W.D.

Adhesion of Finish to Upper Leather

G. L. Amos and G. W. H. Thompson

J. Soc. Leather Trades Chem., **41**, 23–32 (Jan. 1957)

The pigment finish is used to bond the leather to a microscope slide, and the stripping force is measured by adding weights to a hook fastened to the leather; the finish adheres to the slide and is completely removed from the leather. The method is simple, inexpensive, capable of research or production application (by unskilled personnel), and only small samples are required; the results are of good reproducibility. Adhesion varies with position of sampling on any one side of leather. Types of binders, degree of grain correction, nature of dyes, degree of retannage, ammonia concn. in bottom finishing layers, and protein content of finish formulations, all have significant effects on the adhesion of finishes to various kinds of side leather; each of these factors is discussed at some length. J.W.D.

New Developments in Pigment Finishes

K. Eitel

Leder, **7**, 126 (1956): *J. Soc. Leather Trades Chem.*, **41**, 70 (Feb. 1957)

Developments in Europe and the U.S.A. during the past five years in pigment finishing are discussed, with particular reference to polymer binders (acrylates, butadiene, chloroprene, etc.) and pigments. C.J.W.H.

Present and Future Scope of Peptide Synthesis

G. W. Kenner

J. Soc. Leather Trades Chem., **41**, 75–86 (March 1957)

A review, with 52 references to the literature. J.W.D.

α-Helix in Natural and Synthetic Polypeptides

F. Happey

Nature, **179**, 194–196 (26 Jan. 1957)

Natural and synthetic polypeptides in the α-form give two basic types of X-ray diagram — (i) that corresponding to a fairly highly cryst. structure which can be indexed on a hexagonal lattice, involving only one chain per unit cell (Bamford *et al.*, *Nature*, **169**, 357 (1952); **171**, 1149 (1953); *Trans. Faraday Soc.*, **52**, 537 (1956)); a single chain may be in the form of the Pauling–Corey helix (*Proc. U.S. Nat. Acad. Sci.*, **37**, 241, 729 (1951)), as the basis of the screw along the fibre axis. (ii) That which is more diffuse, corresponding to the more amorphous structure. The implications and inter-relations of these are discussed under several headings — chain displacement and the Pauling–Corey helix; effect of mol. displacement parallel to the fibre axis; the 1·5 Å. reflexion; application of displacement theory. It appears possible to correlate the application of the Pauling–Corey helix to all α-polypeptides, both natural and synthetic. J.W.D.

Synthesis of Cystine Peptides

J. A. Maclaren, W. E. Savige, and J. M. Swan

Proc. International Wool Textile Research Conf. Australia, **C**, C 164–C 167, C 479–C 480 (1955)

The synthesis of some cystine peptides related to sequences in insulin has been commenced and provisional results are given. P.G.M.

Kinetics and Mechanism of Aspartic Acid Liberation from Proteins

S. J. Leach

Proc. International Wool Textile Research Conf. Australia, **C**, C 181–C 198, C 482–C 484 (1955)

The early release of free aspartic acid during hydrolysis of proteins with weakly acid solutions has been confirmed. The mechanism of this hydrolysis has been investigated by following the kinetics of acid hydrolysis of simple model peptides containing aspartic acid and asparagine. In weakly acid solutions the peptide or amide bond may be split by an internal mechanism involving a nearby unionised carboxyl group. In stronger acid, the normal bimolecular mechanism involving the hydroxonium ion, which is common to acid hydrolysis of all peptide bonds, becomes more important. This accounts for the failure to observe preferential aspartic acid liberation in strongly acid solutions. P.G.M.

Secondary Factors in the Solubility of Casein

H. G. Higgins

Aust. J. Appl. Sci., **7**, 379 (1956): *J. Soc. Leather Trades Chem.*, **41**, 116 (March 1957)

Attention is drawn to critical factors, largely unrelated to composition, which may influence the solubility of

casein under given conditions; these may be of significance in practical operations in which casein dispersions are used. Data are given on the effect of alkali treatment on solubility and an attempt is made to interpret them mainly in terms of the formation and rupture of hydrogen bonds and salt-linkages. C.J.W.H.

Preparation and Properties of Carboxylated Thiosulphinic Esters
A. Schoeberl and H. Graefje
Proc. International Wool Textile Research Conf. Australia, **C**, C 157–C 163, C 477–C 479 (1955)
The oxidation of disulphide dicarboxylic acids by perbenzoic, monoperphthalic, and peracetic acid to carboxylated thiosulphinic esters (disulphide monoxides) has been investigated. These compounds may be isolated, purified, and handled, in spite of their lability. Their very great reactivity is clear evidence of the class of compounds they belong and it differentiates them from the disulphides. The hydrolysis of these compounds by acids and alkalis has been closely studied and the primary reaction shown to be the formation of two sulphenic acids. Sulphur free acids (acetic and propionic) have also been found among the products of hydrolysis. Attention is drawn to the ready breakdown of the –SO·S– group in wool. The carboxylated thiosulphinic esters react with mercaptocarboxylic acids, and with cysteine in particular, to form unsymmetrical disulphides. This proves to be an important method for the preparation of these compounds. P.G.M.

Reactivity of the Disulphide Bonds in Wool and Hair — Synthesis and Properties of Unsymmetrical Disulphide-dicarboxylic Acids
A. Schoeberl and H. Tausent
Proc. International Wool Textile Research Conf. Austra'ia, **C**, C 150–C 156, C 477–C 479 (1955)
The following disulphide-dicarboxylic acids have been prepared by reaction of sulphenyl chlorides with mercaptocarboxylic acids; carboxymethyl-β-carboxyethyl disulphide, and carboxymethyl *o*-carboxyphenyl disulphide and its monomethyl ester. The preparation of these substances was complicated by their lability. Under ultraviolet radiation these unsymmetrical disulphides undergo a rapid homolytic fission into S radicals, which can initiate a rapid polymerisation of acrylonitrile. The –S·S– bonds in these compounds are especially sensitive to reagents which are able to bring about heterolytic rupture of these functional groups. The action of KCN, Na_2SO_3, and NaOH was studied more closely. The polarisation of these molecules directs the course of the fission. By means of a specific method of estimation, the nature of the mercapto acid formed could be determined. In the case of NaOH, a considerable quantity of thiol is formed; however, this can be accounted for. Unsymmetrically substituted –S·S– compounds are especially labile. P.G.M.

Synthesis and Lanthionine-forming Properties of some Derivatives of Cystine
J. M. Swan
Proc. International Wool Textile Research Conf. Australia, **C**, C 25–C 34, C 452–C 456 (1955)
The following new compounds have been synthesised: monocarbobenzoxy-L-cystine, monocarbobenzoxy-L-cystine dimethyl ester hydrochloride, biscarbobenzoxy-L-cystine diamide, biscarbobenzoxy-L-cystine dihydrazide and its diisopropylidene derivative, biscarbobenzoxyglycyl-L-cystine dihydrazide, biscarbobenzoxy-L-cystine dimethyl ester, and the dimethyl ester, diamide, and dipiperidide of bis-*p*-toluene-sulphonyl-L-cystine. An improved synthesis of bis-*p*-toluenesulphonyl-L-cystine is described. These compounds, and a number of other cystine derivatives, have been used in an investigation of the cystine → lanthionine reaction.

On heating with 0·1N–Na_2CO_3 or 0·2N–NaCN, positive indications of the formation of lanthionine were observed with a number of carbobenzoxycystine derivatives, with L-cystine dimethyl ester, L-cystine diamide, and in very low yield with cystine itself. The desirability of using cystine derivatives as model compounds for interpreting protein disulphide chemistry is emphasised. P.G.M.

New Derivatives of Lanthionine
H. Zahn and F. Osterloh
Proc. International Wool Textile Research Conf. Australia, **C**, C 144–C 149, C 476–C 477 (1955)
The bishydantoin, bisphenylurea, bisphenylhydantoin, and diethyl ester dihydrochloride derivatives of *meso*-lanthionine have been prepared. Also, *meso*lanthionine has been oxidised to its sulphoxide and sulphone. P.G.M.

Synthetic Amphoteric Polypeptide
I— Synthesis and some Properties of Linear Amphoteric Polypeptides
H. Yuki, S. Sakakibara, and H. Tani
Bull. Chem. Soc. Japan, **29**, 654–660 (Aug. 1956)
Two linear amphoteric polypeptides—copoly-1:1:3-(DL-glutamic acid, DL-lysine, DL-phenylalanine) and copoly-1:1:1·9-(L-glutamic acid, L-lysine, L-leucine)—have been prepared. The variations in viscosity and optical rotation of their soln. with changes in pH show some resemblance to those of vinyl polyampholytes and proteins. A.J.

II— Synthesis and some Properties of a Reversibly Contractile Amphoteric Polypeptide
H. Yuki, S. Sakakibara, T. Taki, and H. Tani
Ibid., 664–669
Copoly-26:26:1-(L-glutamic acid, L-lysine, DL-cystine) is reversibly contractile, being contracted in its isoelectric region and extending in both acidic and basic soln. In aqueous media the load-extension relation of strips of polypeptide foil is linear for loads up to 2000 × wt. of a 1-cm. length of strip. From temp.–elongation data it is concluded that internal energy and entropy both increase on isothermal elongation of the strip. A.J.

PATENT

Leather Dressing and Colouring
FBy *BP* 769,730
Aqueous emulsions of oily-viscous copolymers of butadiene and acrylonitrile yield coatings on leather which have not the slightest tackiness. The copolymers are such that their hardness can no longer be determined with a Defo measuring instrument and are obtained by adding a chain-terminating agent at a suitable stage during their polymerisation. They can be mixed with conventional casein coatings and suitable dyes. C.O.C.

Imparting Microbicidal Properties to Textiles, Rubber, Paper, Leather, Plastics, Ceramics, etc. (X p. 351)

XIII— RUBBER; RESINS; PLASTICS

Intermolecular Structure of High Polymers. XXII— Increasing the Reactivity of High Polymers
A. N. Bŷkov and A. B. Pakshver
Colloid J. U.S.S.R., **19**, 27–30 (Jan.–Feb. 1957)
The reactivity of 6-nylon, cellulose acetate, and cellulose is greatly increased, as shown by the rate of adsorption of dyes and acids, by the introduction of a neutral substance, such as benzene or alcohol, into the polymer after the latter has undergone a preliminary swelling treatment. G.J.K.

Compatibility of Nitrocellulose and Butadienenitrile Copolymers. III— Dependence of the Gloss Temperature and Flow of Nitrocellulose Films on the Content of Different Butadienenitrile Copolymers
L. E. Kalinina, V. I. Alekseenko, and S. S. Voyutskii
Colloid J. U.S.S.R., **19**, 51–58 (Jan.–Feb. 1957)

Behaviour of Organic Pigments in High-temperature Systems
W. Carr and C. Musgrave
J. Oil & Col. Chem. Assocn., **40**, 51–61 (Jan. 1957)
The suitability of a pigment for use in plastic materials depends not only on its intrinsic fastness properties but, equally importantly, on its ability to withstand the conditions of processing and those obtaining in the finished plastic medium. Resistance to heat degradation, to the action of organic solvents (polar and non-polar), and to reducing conditions, is particularly important. The behaviour of 14 organic pigments when used in stoving finishes and laminated plastics (paper bonded with urea–, melamine–, resorcinol–, or phenol–formaldehyde resin) is

discussed, and the results are tabulated. The performance of 10 organic pigments in bulk articles (sheet, mouldings, extrusions, coatings, etc.) made from phenol-formaldehyde, polyvinyl chloride, polystyrene, and polyethylene, is also discussed; the results relating to heat stability and chalk-resistance are tabulated, together with those obtaining when the medium is urea-, or melamine-formaldehyde resin. J.W.D.

Problems in the Colouring of Plastics
C. Musgrave
Chem. and Ind., 229–230 (23 Feb. 1957)

The heat stability of a plastic composition is affected by time, temp., medium (polymer), formulation, and the nature of the colour; in practice it is the medium which has the most important effect. Six different polyvinyl chloride polymers gave marked differences in initial shades of colour and in heat stability; in some cases there was an improvement in stability when the polymer was first washed with distilled water, but washing did not bring all six polymers to the same level. Heat stabilities were not always in the same order, but varied with the pigment used. The only marked effect due to plasticisers is that of the aryl phosphates (which darken at high temp.), and plasticisers which may develop acidity. Certain stabilisers can lead to colour differences. Light stability depends upon pigment nature and concn., formulation of the medium, and the conditions of exposure. Different polyvinyl chloride polymers gave a great variation in light-fastness; once more there is an improvement in stability upon water-washing. Stabilisers have a profound effect on light-fastness. Various titanins of apparently differing light-stability showed no difference when adjusted to give the same opacity. There is evidence that colour migration (leading to chalking) passes through a clear min. as the colour concn. is increased from a low level J.W.D.

PATENTS

Treatment of Natural Rubber Surfaces
Dunlop Rubber Co. *BP* 771,120

The trouble, e.g. tack, caused by plasticisers or other components which tend to migrate to the surface of articles made from natural rubber, may be avoided by treating the surface with an adhesive for nylon, e.g. diphenylmethane di*iso*cyanate in xylol, and then with a solution of nylon. The nylon layer so formed acts as a barrier to the passage of the components which tend to migrate. C.O.C.

Pigmented Polyethylene
Monsanto *BP* 771,955

Polyethylene is uniformly pigmented by melting it under pressure in a totally enclosed vessel and then adding the pigment while the polyethylene is molten and under pressure. C.O.C.

Treatment of Polyvinyl Surfaces
Dunlop Rubber Co. *BP* 771,121

The tendency of polyvinyl surfaces, e.g. plasticised poly(vinyl chloride) to show "drag" and tack, to pick up and show dirt and have imperfect oil-resistance is removed by treating them with a solution of an organic di*iso*cyanate and then with an alcoholic solution of nylon. The solution of nylon may contain a colorant. More than one coating of nylon may be applied and the coatings may be of different colours. C.O.C.

Unitary, Multicoloured, Plastic Film
Decal Plas-Stik Co. *BP* 770,462

A fluid plastic material is screen printed on to a smoothly inert, preferably metal, surface and heated to cake it enough to make it form a flexible film. A second differently coloured batch of the material is then printed on so that at least some of it overlaps the first print and is then heat set. Successive printings are similarly made. One at least of the printings covers the whole area. The last printing is cured at a higher temperature than the others so as to cure the composite film, which is then stripped from the inert surface. C.O.C.

Preventing Surface Crazing or Frosting of Rubber-Resin Blends
United States Rubber Co. *BP* 770,856

Addition of 0·1–5·0 parts by weight of an alkylene polyamine to blends of styrene-acrylonitrile resin and butadiene-acrylonitrile rubber prevents formation of a whitish coating when the moulded or calendered blend is allowed to stand. C.O.C.

Rheological Behaviour of Hydrogen-bonded Solids. I—Primary Considerations (VI p. 341)
Theory of Stress Relaxation—Relaxation in Wool and *iso*Butylene Polymers (VI p. 345)
Imparting Microbicidal Properties to Textiles, Rubber, Paper, Leather, Plastics, Ceramics, etc. (X p. 351)

XIV—ANALYSIS; TESTING; APPARATUS

Process Control by Flow Colorimetry
B. F. Dudenbostel and W. Priestley
Ind. Eng. Chem., **48**, 49 A–50 A (Dec. 1956)

Colour specifications can be applied to the continuous monitoring of plant streams. A flow colorimeter consists essentially of a source, a filter to obtain a narrow wavelength band, sample cell, detector, and measuring system. In a ratio-recording flow colorimeter a single beam of light passes through the sample and is then split into two beams, one of which passes through a filter which transmits the measuring (absorbed) wavelength, while the other passes through a filter which transmits a non-absorbed wavelength. The ratio of the outputs of photocells in the two beams depends only on colour, being unaffected by bubbles, turbidity, window deposits, etc. Continuous flow colorimetry has been employed to monitor filtration processes, waste water, process water in papermaking, chlorophyll and other pigments in refined vegetable oils, paraffin, chlorine dioxide in bleaching liquors, and chromate and dichromate in waste water. C.J.W.H.

New Complexing Agent for Titration of Calcium in presence of Magnesium
R. W. Schmid and C. N. Reilley
Anal. Chem., **29**, 264–268 (Feb. 1957)

The complexing agent, [ethylenebis(oxyethylenenitrilo)]-tetra-acetic acid, enables calcium to be determined in presence of magnesium. The end-point is detected potentiometrically with a mercury electrode. L.T.W.

Comparison of the Detergent Properties of Washing Powders
K. Ramaszéder and M. Sághy
Textil Praxis, **12**, 169–171 (Feb. 1957)

A synthetic soiling medium of the following composition is used—Emugol oil F 13 (10%), soot (5%), dust (3%), ammonium hydroxide (1%), and calcium carbonate (1%), all quantities being calculated on wt. of material. A 50 : 50 union of wool and viscose rayon is used, the soiled material being dried and examined for white content, washing tests are then carried out in Thermos flasks rotated mechanically, and the washed material is tested for white content. The detergent effect (M%) is calculated from the following formula—

$$M = \frac{W_g - W_v}{W_r - W_v} \times 100$$

(W_r = white content of clean material; W_v = white content of artificially soiled material; and W_g = white content of washed material). B.K.

4-*p*-Phenylazophenylsemicarbazide and its Use in Chemical Analysis
M. Winter, E. Demole, and E. Sundt
Helv. chim. Acta, **40**, 467–476 (March 1957)

Coal-tar Colours. XXI—D&C Red No. 6 and D&C Red No. 7
C. Stein
J. Assocn. Off. Agric. Chem., **39**, 973–975 (Nov. 1956)

The preparation of a pure sample of D&C Red No. 6 is described. The accuracy of the titanium trichloride titration and that of the spectrophotometric methods for the quantitative determination of D&C Red No. 6 and D&C Red No. 7 are confirmed. P.G.M.

Porosity in Fibres
C. O. Bostwick
J. Polymer Sci., **24**, 150–152 (March 1957)

A method of observing voids in synthetic fibres involving the use of dark-field illumination. W.R.M.

Measurement of the Degree of Carrotting of Hatters' Fur (for the Estimation of Felting Properties)
Textile Institute

Tentative Textile Standard No. 42 (1957): *J. Textile Inst.*, **48**, P 166–P 168 (Feb. 1957)

The degree of carrotting, the ease of felting, and the solubility in alkali are interrelated. Thus, for a given fur, determination of its alkali solubility gives information about the carrotting it has received and its felting properties. The fur is dried and weighed, immersed in 0·10 N-NaOH for 1 hr. at 65°C., and then filtered, washed, dried, and reweighed. The loss in weight is calculated as a percentage (called the *HAFRA number*) of the dry weight of the fur. Standard experimental conditions are given. Furs from different animals with the same alkali solubility may not necessarily have the same felting properties. So far, only fur from wild and tame rabbits has been used for the test. P.T.S.

Carrotting of Fur— Investigation of Factors influencing the Accuracy of a Tentative Standard Method of Test
T. Barr, J. A. C. Watt, and R. Withington

J. Textile Inst., **48**, P 169–P 178 (Feb. 1957)

Carrotting entails scission of disulphide bonds in furs, and this affects the ease with which the fur is felted and also its solubility in alkali. Thus, a test (see previous abstract) was devised in which the degree of carrotting and subsequent ease of felting were estimated via the alkali solubility of the fur. This paper shows experimentally that, in fact, the ease of felting of a fur is related to the alkali solubility. It also describes elaborate and detailed experiments to determine the reliability of the test procedure, and gives a statistical analysis of the results of tests by skilled, semi-skilled, and unskilled operators. When the test is carried out by experienced operators, the normal variation in results is less than ± 0·5%. P.T.S.

Determination of Cellulosic and Glass Fibres in Mixtures with Asbestos
C. Z. Carroll-Porczynski

J. Textile Inst., **47**, T 651–T 652 (Dec. 1956)

A mixture of cellulosic fibres, glass, and asbestos is conditioned for 1 hr. at 70°C. and 65% R.H. and weighed. It is then heated in an open crucible in an electric oven at 370 ± 10°C. for 1 hr., and after cooling and conditioning it is reweighed. The loss in weight gives the cellulose content of the sample. The sample is then heated to 800°C. for 1 hr., cooled, conditioned, and weighed again, and the asbestos content is calculated assuming that it has lost 13% of its weight and that there is no loss in weight of the glass content. The experimental basis of the estimation is given in this paper, and so are precautions to be taken if the sample is contaminated by, e.g. oil. P.T.S.

Standard Soils
AATCC Standard Soils Committee

Amer. Dyestuff Rep., **45**, P 946–P 950 (17 Dec. 1956)

This progress report describes standard washing procedures and standard methods of estimating the efficiency of washing artificially soiled fabrics which are necessary in any attempt to compare detergent efficiency. The standard use of the AATCC Launder-Ometer is systematically described, and the conditions for standard measurements of reflectance, which is a measure of the efficiency of the washing, are given. The paper includes a statistical analysis of the results of tests from eight laboratories on eight fabrics (dynel, Dacron, Acrilan, cellulose acetate, viscose rayon, silk, Orlon, and nylon) using two detergents. It is unlikely that a method of producing artificially soiled fabrics can be found which could be used to test the efficiency of all detergents; a specific soiled fabric will be needed for each. P.T.S.

Quantitative Determination of Indigo on Wool or Cotton
J. Khachoyan

Teintex, **22**, 93–102 (Feb. 1957)

On wool, the dye is extracted with *o*-chlorophenol (I) at 100°C. for 1–2 hr., and the extract compared colorimetrically against known indigo–I solutions. The method can be modified for estimating indigo vats or points topped with acid or chrome dyes. On cotton, the fibre is first swelled with glacial CH_3COOH and then treated as for wool. Modification is possible for basic toppings.
S.R.C.

Critical Appraisal of the International Daylight Fastness Test
K. McLaren

J.S.D.C., **73**, 121–127 (April 1957)

The international daylight fastness test has been critically examined to determine its reproducibility and its reliability. Only one variable factor in exposure— the effective humidity— has been found to cause variations in assessment, and this is governed primarily by the proportion of sunlight falling on the pattern during exposure. This causes the assessments of humidity-sensitive materials to be up to 2 grades higher in sunny countries than in predominantly cloudy regions. This variation can be eliminated only at the expense of the reliability of the result, a solution which cannot be accepted. There is evidence to suggest, however, that the reproducibility of the method would be very good for the majority of fabrics, whose sensitivity to humidity, like that of the standards, is low. The test is a reliable guide to the expected resistance to fading which will occur during use, even of sensitive materials, providing that the daylight test is carried out in the same country as that in which the fabric is to be used or in one whose climate is similar and providing that the fabric does not become wetted during use. Author

Prexa Apparatus for Washing and Milling Fastness Tests

Textil Praxis, **12**, 161 (Feb. 1957)

The Prexa apparatus is manufactured by Wullschleger & Schwarz, Basle, and is designed to carry out washing and alkaline milling tests according to ISO recommendations. It can also be used for wet-rubbing and felting tests.
B.K.

Identification of Sizings on Fabrics woven from Synthetic Filament Yarn
C. R. Trommer

Text. Research J., **27**, 66–72 (Jan. 1957)

A system of qualitative analysis for sizes in current use on synthetic-fibre fabrics. The tests, which are carried out on a distilled-water extract of the fabric, are mostly based on precipitation and colour reactions. J.C.F.

Determination of Resin Finish in Textile Materials treated with Urea–Formaldehyde
Textile Institute

Tentative Textile Standard No. 41 (1956): *J. Textile Inst.*, **47**, P 1029–P 1030 (Dec. 1956)

The test is applicable to cotton, linen, viscose rayon and cuprammonium rayon fabrics, and mixtures of these fibres with cellulose acetates and with wool, finished with urea–formaldehyde. It is not applicable to melamine–formaldehyde finishes. "Resin finish" means all substances applied to the fabric which are removed by dil. HCl. Dextrin and water-soluble softening agents are often included in the finish. A known dry weight of material is extracted with hot (60–65°C.) 0·1 N-HCl for 1 hr. to remove the finish, and then the residue is thoroughly washed, dried, and weighed. The result is expressed as the loss in weight calculated as a percentage of the dry weight of the extracted specimen. P.T.S.

Determination of Resin Content of Fabrics treated with Urea–Formaldehyde Resins
J. Tankard

J. Textile Inst., **47**, P 1031–P 1034 (Dec. 1956)

Five methods for the determination of the resin content of fabrics have been investigated to determine their relative reproducibility and accuracy— (*a*) treatment for 1 hr. at 60°C. with 0·1 N-HCl; (*b*) two successive treatments for 15 min. at 65°C. with 0·2 N-HCl; (*c*) boiling for 20 min. in 1% tartaric acid; (*d*) treatment for 1 hr. at 95–97°C. with buffered acetic acid at pH 4·6; and (*e*) estimation of nitrogen by the Kjeldahl method. The first three methods give results for the resin contents of fabrics which do not differ by more than 1% when the content is approx. 12% on the dry weight of the fabric. The results are reproducible in the hands of different analysts. Method (*d*) shows some residual amount of formaldehyde and thus gives unsatisfactory results. Method (*c*) is not satisfactory because the resin : nitrogen ratio is not constant, and nitrogen from dyes introduces an error. None of the first three methods degrades viscose rayon appreciably. Oven-drying before the tests does not cause appreciable loss of formaldehyde. P.T.S.

Determination of Urea-Formaldehyde Resins in Coatings by Analysis for Urea
M. H. Swann and G. G. Esposito
Anal. Chem., **28**, 1984 (Dec. 1956)
The liberation of ammonia from urea–formaldehyde coating resins on treatment with alkali is characteristic, and provides a rapid quant. method of analysis. L.T.W.

Tentative Specification for the Larval Testing of Mothproofed Wool Serge
International Wool Textile Organisation
J.S.D.C., **73**, 161–165 (April 1957)

Absolute Crystallinities of Celluloses from Moisture Sorption Determinations
L. Valentine
Chem. and Ind., 1279 (3 Nov. 1956)
A comparison of sorption ratio (S.R. = ratio of moisture sorption of a cellulose to that of cotton) for a number of celluloses, with the appropriate values of amorphous fraction F_{am} as determined by infrared studies of celluloses treated with D_2O vapour, shows that a linear relation exists between them. Thus, S.R. = 2·6 F_{am}. Since sorption ratios are readily measured, a simple means is now available for the quantitative determination of the crystallinity of celluloses. A.J.

Crystallinity of Celluloses
G. C. Gibbons
Chem. and Ind., 44 (12 Jan. 1957)
Criticism is made of the use of cotton as a primary standard for obtaining the values of the sorption ratio (the ratio of the sorption of any cellulose to that of cotton under the same conditions) as a general method of determining the "absolute" crystallinities of celluloses (L. Valentine, *ibid.*, 1279 (3 Nov. 1956)). The points of criticism are firstly that the regain of cotton is known to vary with the previous history of the sample, and secondly that the sorption ratio itself may depend on the method of determining regain. W.J.M.

Experimental Evaluation of the Lateral-order Distribution in Cellulose
R. Marchessault and J. A. Howsmon
Text. Research J., **27**, 30–41 (Jan. 1957)
The lack of agreement among various crystallinity and accessibility methods for cellulosic materials is explained in terms of the lateral-order distribution concept. A new definition of the order function is proposed which is more in keeping with recent infrared evidence showing that celluloses differ in distribution of hydrogen-bond strengths rather than in actual number of hydrogen bonds. Some of the physical and chemical methods which can give empirical order distribution information for native and regenerated samples are reviewed critically, and some data are compared with results based on conventional crystalline–amorphous delineation. J.C.F.

Complexometric Estimation of Iron in Cellulose Pulps
B. Philipp and H. Hoyme
Faserforsch. und Textiltech., **8**, 34–35 (Jan. 1957)
Cellulose is ashed and the ash dissolved in acid. The pH is adjusted to 2–3 by addition of ammonia, and the solution titrated with Komplexon III solution. The results agree with those obtained by colorimetric methods. W.R.M.

Determination of Trace Amounts of Copper
L. G. Borchardt and J. P. Butler
Anal. Chem., **29**, 414–419 (March 1957)
A survey of the literature and a comparison of colorimetric methods of determining copper are made, and a procedure using 2:9-dimethyl-4:7-diphenyl-1:10-phenanthroline (bathocuproine) as reagent is recommended. Application of the method to cellulosic materials is preceded by wet-ashing with a mixture of nitric and perchloric acids. L.T.W.

Measurement of Permeability of Plastics, Leather, and similar Materials to Water
J. Sivadjan
J. Polymer Sci., **24**, 63–66 (March 1957)
A method of measuring permeability by the use of hygrosensitive plates. W.R.M.

Molecular Weight Determination of High Polymers
K. Edelmann
Faserforsch. und Textiltech., **8**, 30–32 (Jan. 1957)
A discussion of the reasons why different average molecular weights are obtained by different methods of determination. W.R.M.

Chromatography on Ion-exchange Resins applied to the Reaction of Wool Keratin with Alkali
S. Blackburn and G. R. Lee
Proc. International Wool Textile Research Conf. Australia, **C**, C 137–C 141, C 473 (1955)
A method is described for the determination of lanthionine in amino-acid mixtures, involving chromatographic separation on ion-exchange resin followed by reaction with ninhydrin at about pH 1, the yellow colour produced being determined spectrophotometrically at 455 mμ. Preliminary results of the application of the method to a series of alkali-treated wools are given. P.G.M.

Quantitative Microdetermination of Amino Acids on Paper Chromatograms
S. Blackburn and A. Robson
Proc. International Wool Textile Research Conf. Australia, **C**, C 87–C 91, C 465 (1955)
Paper-chromatographic methods for the microdetermination of amino acids are briefly reviewed, and the application of a radiometric method, based on the use of ^{64}Cu, is described and discussed. P.G.M.

Secondary-valence Interactions and the Separation of Larger Peptides
R. L. M. Synge
Proc. International Wool Textile Research Conf. Australia, **B**, B 9–B 13, B 268 (1955)
With increased molecular size, secondary-valence interactions between peptide molecules determine to an increased extent the analytical behaviour. For structural chemical investigations greater use should be made of dissociating agents not normally used in biochemistry. These agents may destroy biological activity, etc. by disrupting secondary-valence bonds but should maintain the primary-valence structure intact. P.G.M.

Determination of the Relative Viscosity of 6,6-Nylon Yarn in 90% Formic Acid
A. S. Smith
J. Textile Inst., **48**, T 86–T 97 (March 1957)
This method is very much quicker than the usual method of determining the relative viscosity (R.V.) in *m*-cresol, and the coefficient of variation of results using the formic acid method is approx. half that of determinations using the *m*-cresol method. The effect on the R.V. of errors in the acid strength, in the weight of nylon dissolved in the acid, and in the moisture content of the nylon was investigated, and experimental details are given for the modified and refined test. P.T.S.

Colorimetry—Errors and Accuracy
W. D. Wright
Nature, **179**, 179–180 (26 Jan. 1957)
Brief report of a symposium held by the Physical Society Colour Group. The various available types of colour-measuring instruments are briefly discussed; none can yet equal the power of discrimination of the human eye. Six coloured tiles, supplied by the British Ceramic Research Association, have been examined using ten different spectrophotometers (5 recording, 5 non-recording); the tiles varied both in colour and in surface characteristics (from glossy to dead matt). The differing results obtained are discussed and explanations suggested. On the assumption that the average values from the five non-recording instruments were the most nearly correct, the Müller–Hilger "Uvisir" double monochromator was the most accurate, with the Beckmann spectrophotometer a close second. The agreement amongst the results was regarded by the instrumentalists as gratifying, but the practical colour men were much less enthusiastic. Studies carried out at the Paint Research Station, based upon a set of closely similar, progressively graded paint panels, have shown that the Beckmann spectrophotometer gives a precision with repeat measurements that is comparable with the closest commercial tolerances for colour variation. A comparison of the performances of the General Electric recording spectrophotometer with a Librascope computer,

the Donaldson six-colour colorimeter, and the Colormaster differential colorimeter, is briefly reported.
J.W.D.

Colour Measurement Forum—Practical Applications of Colorimetry in Development and Control of Organic Finishes

Off. Dig. Fed. Paint Varn. Prod. Cl., **28**, 1276–1322 (Dec. 1956)

Papers are presented under the following headings—colour measurement with the General Electric Spectrophotometer, use of Gardner Color Difference Meter for production control of shading operations, colour measurement with the I.D.I. Color Eye, visual control of colour (the Davis–Bruning Colorimeter), an application of the Beckmann Model DU Spectrophotometer to paint colour control, and an application of the Colormaster Differential Colorimeter for control and evaluation of maintenance paints.
J.W.D.

Purkinje Shift and Retinal Noise

H. B. Barlow

Nature, **179**, 255–256 (2 Feb. 1957)

The displacement of the max. sensitivity of the eye towards the blue end of the spectrum at low levels of ambient illumination (the Purkinje shift) occurs in a wide variety of vertebrates; there is no satisfactory explanation of the advantage derived from evolving different photosensitive systems with different spectral sensitivity curves for use at high and low levels of illumination. Recent theories bearing upon this are discussed and it is further concluded that, if it is accepted that thermal decomp. of rhodopsin is an important factor limiting the absolute sensitivity of the eye, then (i) photosensitive substances sensitive to longer wavelengths than rhodopsin are likely to be much less stable, and this may be the cause of the lower sensitivity of the cones which contain them; (ii) the decreased rate of thermal breakdown that can accompany a shift of spectral sensitivity to the blue may be the factor of survival value that explains the evolution of the Purkinje shift.
J.W.D.

Century of Colour-fastness Testing of Textiles

M. L. Staples

Canadian Textile J., **73**, 49–53 (30 Nov.) and 80–89 (14 Dec. 1956):

Amer. Dyestuff Rep., **46**, P 199–P 211 (25 March 1957)

A history of developments in testing the fastness of dyes to washing, light, and perspiration with shorter notes on other fastnesses—to abrasion, gas fumes, pressing, acids, alkalis, bleaching, etc. Full details of the present state of progress are given, as well as views on the development of international standards and future progress in colour-fastness testing. 130 references.
P.T.S.

Biochemical Reduction of Organic Compounds
II—Fading of Coal-tar Dyes by Decolorising Bacteria

E. Miyanichi, Y. Ose, and M. Otake

Gifu Yakka Daigaku Kiyō, No. 6, 27–30 (1956)

Bacteria which decolorised the pigment isolated from fukushinzuke (sliced vegetables preserved in soy sauce) was applied to about 100 dyes. Azo dyes were markedly decolorised, followed by nitro and indigoid dyes. Pyrone, triphenylmethane acid and hydroxypyrazolone dyes were comparatively resistant, and "sulphite" and basic dyes were the most stable. Dyes containing reducible groups are strongly decolorised, suggesting that the fading is caused by reduction. Enzymes play a part in this reduction. Some dyes containing a reducible group are stable, presumably because of the degree of oxidation–reduction potential.

III—The Dye-reductase in the Decolorising Bacteria

E. Miyamidi and Y. Ose

Ibid., 31–35;

Chem. Abs., **51**, 4715 (25 March 1957)

The enzyme responsible has been isolated. Its action proceeds in two stages: first dehydrogenation of the substrate and then reduction of the diazo radical.
C.O.C.

Assay of Cyanoethylated Cotton

G. E. Journeay and J. E. Blackmon

Text. Research J., **27**, 166–167 (Feb. 1957)

Omission of the sulphuric acid digestion stage in the determination of N in cyanoethylated cotton by the Kjeldahl method (Daul, Reinhardt, and Reid, *ibid.*, **25**, 246, 1955)) gives low results (up to 42% error) with certain types of cyanoethylated cotton. It is recommended that the standard Kjeldahl procedure be used in all cases.
J.C.F.

Detection of Fungal Growth in Cellulosic Textiles

G. R. F. Rose, M. Mitton, B. J. Gardner, D. M. Laird, and C. H. Bayley

Text. Research J., **27**, 99–110 (Feb. 1957)

Staining techniques available for the detection of microbiological damage in cellulosic fibres are reviewed. A modification of the Pianese IIIb test is described which gives a clear-cut differentiation of colour between hyphae and substrate. It is applicable to a range of cellulosic fibres and also to dyed fibres. The test may also be of use in determining the degree of maturity of cotton fibres.
J.C.F.

Scintillation Spectrometry applied to Activation Analysis with special regard to Copper and Manganese

I. Fineman, K. Ljunggren, L.-G. Erwall, and T. Westermark

Svensk Papperstidning, **60**, 132–134 (28 Feb. 1957)

This method is applied to the determination of impurities or precious metals in very low concentration by means of neutron-induced radioactivity of these metals; e.g. Cu and Mn in cellulose, oils, and drugs can be determined in concentrations of 1–10 p.p.m.
K.W.

Microscopic Examination of Cellulose Fibres under Polarised Vertical Illumination

C. A. Carlsson and N. Hartler

Svensk Papperstidning, **60**, 92–95 (15 Feb. 1957)

Wood cellulose fibres seen in the microscope under polarised light are normally bright except for certain characteristic dark areas surrounded by interference bands that have been explained by Emerson and Watts as being due to the exposed secondary wall, the bright areas representing the intact primary wall. This interpretation is shown to be erroneous as the observable phenomena depend on whether or not the fibre is in contact with the glass slide. The technique does not, therefore, give any direct information about the primary wall.
K.W.

Stability of the Glycosidic Linkages in Carbohydrates

W. G. Wright

J.C.S., 1913–1916 (April 1957)

Lactose, cellobiose, and turanose are almost completely oxidised by periodic acid in 24 hr., with fission of the glycosidic linkage, whereas sodium or potassium periodate attacks only the α-glycollic functions in that time. This indicates a method for detecting the degree of hydrolysis of carbohydrates with mineral acids, and is applicable also to keto-sugars, where the reducing groups cannot be estimated in the usual manner with hypoiodite.
H.H.H.

Evaluating Cellulose Acetylation Reactivity

C. J. Malm, K. T. Barkey, J. T. Schmitt, and D. C. May

Ind. Eng. Chem., **49**, 763–767 (April 1957)

Determination of Sulphate Acid Ester in Unstabilised Cellulose Nitrate

P. E. Gagnon, K. F. Keirstead, and D. Yamasaki

Canadian J. Technol., **34**, 477–484 (March 1957)

The sulphate ester in unstabilised cellulose nitrate can be determined satisfactorily by—(i) titration in water, (ii) determination of Cs after ion exchange, (iii) hydrolysis in acetone–water, or (iv) determination of sulphate after treatment with 50% ethanol.
J.W.D.

Thermistor Method for the Determination of Velocity Coefficients of Vinyl Polymerisation—I–III

H. Miyama

Bull. Chem. Soc. Japan, **29**, 711–715, 715–719, and 720–724 (Aug. 1956)

New Indicator for Complexometric Titration of Calcium in presence of Magnesium

G. P. Hildebrand and C. N. Reilley

Anal. Chem., **29**, 258–264 (Feb. 1957)

The indicator (C.I. Mordant Black 17, Calcon) enables accurate complexometric titration of calcium with (ethylenedinitrilo)tetra-acetic acid to be carried out in presence of magnesium at pH 12·3 in a diethylamine buffer. The end-point is indicated by a colour change from pink to blue.
L.T.W.

Amperometric Titration of Dodecylpyridinium Bromide with Sodium Dodecyl Sulphate
N. Tanaka and R. Tamamushi
Nature, **179**, 311–312 (9 Feb. 1957)

Dodecylpyridinium bromide in soln. of concn. 0·1–1·0 mM. has been titrated amperometrically at the potential of −1·325 V. (against a saturated calomel electrode) with a 2 mM. or 10 mM. sodium dodecyl sulphate soln. in 0·1 N-NaOH–0·2 mM. polyoxyethylene lauryl ether, using a dropping Hg electrode as indicator electrode. The method, which has an accuracy of ±0·005 mM. in terms of the standard deviation in the above concn. range, is rapid and is particularly valuable at low concn. of the detergents. J.W.D.

Microanalysis with Ion-exchange Resins
M. Fujimoto

III— Detection of small amounts of Sulphide with *p*-Aminodimethylaniline and *p*-Phenylenediamine
Bull. Chem. Soc. Japan, **29**, 567–571 (July 1956)

The sensitivity of the reaction between small amounts of sulphide and *p*-aminodimethylaniline or *p*-phenylenediamine oxidised with $FeCl_3$ to yield Methylene Blue or Lauth's Violet respectively is greatly enhanced by the presence of a cation-exchange resin. Details of the effects of other ions and of varying the experimental conditions are given.

VI— Detection of small amounts of Nitrite with *m*-Phenylenediamine
Ibid., 600–604

The reaction of nitrites with *m*-phenylenediamine in acid soln. to yield Bismarck Brown is utilised, the dye being adsorbed on a cation-exchange resin. A.J.

Modified Folin Method for estimating Primary and Secondary Amines
K. Blau and W. Robson
Chem. and Ind., 424–425 (6 April 1957)

A spectrophotometric modification of the method of Folin (*J. Biol. Chem.*, **51**, 377, 386 (1922)). Limits of estimation are tabulated for 19 substances including several amino acids. Colour development is inhibited slightly by Ca^{2+}, Cd^{2+}, Ba^{2+}, Mg^{2+}, Zn^{2+}, Sr^{2+}, and Fe^{2+}, and strongly by Ag^+, Cu^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}, and Fe^{3+}; the reagent is bleached by Hg^{2+}, Pb^{2+}, Sn^{2+}, and Al^{3+}. The disodium salt of ethylenediaminetetraacetic acid, and dioxan, are also strong inhibitors, whilst creatine and urea cause bleaching. J.W.D.

Determination of Thermodynamic Dissociation Constants from Absorption Spectra with Applications to *o*- and *p*-Phenylenediamines
T. Anno and A. Sadô
Bull. Chem. Soc. Japan, **29**, 620–625 (July 1956)

For a dinoid base in soln.—

$$D = \frac{Lc\left[\varepsilon_1 + \frac{K_{1b}}{a_{OH}}\varepsilon_2 + \frac{K_{1b}K_{2b}}{a_{OH}^2}\varepsilon_3\right]}{1 + \frac{K_{1b}}{a_{OH}} + \frac{K_{1b}K_{2b}}{a_{OH}^2}} \quad \text{(i)}$$

where D is the optical density, in a cell of length L, of a soln. having hydroxyl ion activity a_{OH} and a concn. c of the base in all its forms; ε_1, ε_2, and ε_3 are the molar extinction coefficients of the undissociated base B and its singly and doubly charged ions BH^+ and BH_2^{2+} at a fixed wavelength; K_{1b} and K_{2b} are the apparent first and second dissociation constants of the base, defined by—

$$K_{1b} = \frac{a_{OH}[BH^+]}{[B]}$$

$$\text{and } K_{2b} = \frac{a_{OH}[BH_2^{2+}]}{[BH^+]}$$

From equation (i) is derived—

$$D'x - y + \frac{(D' - \varepsilon_3)z}{a_{OH}} = (\varepsilon_1 - D')a_{OH} \quad \text{(ii)}$$

where $D' = D/Lc$, $x = K_{1b}$, $y = K_{1b}\varepsilon_2$, and $z = K_{1b}K_{2b}$. ε_1 and ε_3 reduce to D' in alkaline (pOH $<$ pK_{1b}) and acidic (pOH $<$ pK_{2b}) solns. respectively, and hence are readily determined. Substitution of the values of D' at three intermediate pH values into (ii) gives three linear simultaneous equations from which x, y, and z (and hence K_{1b} and K_{2b}) may be derived. If $K_{1b}/K_{2b} \gg 1$, the three pH values are chosen such that a_{OH} approx. equals $(K_{1b}K_{2b})^{0.5}$, K_{1b} and K_{2b}; and if $K_{1b}/K_{2b} \simeq 1$, such that pOH $\simeq$ pK_{1b} with intervals of 0·3–0·5 pH unit. Values of the dissociation constants of *o*- and *p*-phenylenediamine are measured by this method and agree well with literature values. The second dissociation constant of the *ortho* isomer, so far unknown, is $1{\cdot}3 \pm 0{\cdot}1 \times 10^{-14}$ at 14·5°C. A.J.

Coal-tar Colours. XXI— D&C Red No. 6 (C.I. 15850, Na salt) and D&C Red No. 7 (C.I. 15850, Ca salt)
C. Stein
J. Assocn. Off. Agric. Chem., **39**, 973–975 (1956): *Chem. Abs.*, **51**, 4715 (25 March 1957)

A pure sample of the Na salt of 4-(*o*-sulpho-*p*-tolyazo)-3-hydroxy-2-naphthoic acid (C.I. 15850, D&C Red No. 6) was prepared by coupling diazotised purified *p*-toluidine-*m*-sulphonic acid with purified 2-hydroxy-3-naphthoic acid. The maximum absorbances of the dye in 0·1 N–HCl and 0·1 N-NaOH are at 520 and 492 mμ. respectively. These solutions obey Beer's law. The accuracy of the $TiCl_3$ titration and the spectrophotometric methods for quantitatively determining D&C Red No. 6 and 7 (C.I. 15850, Na and Ca salts respectively) is confirmed. C.O.C.

Spectral Absorbance of some Aqueous Solutions in the Range 10–40°C.
E. E. Sager and F. C. Byers
Bur. Stand. J. Res., **58**, 33–36 (Jan. 1957), *Research Paper* 2731

The absorption spectra in the ultraviolet and part of the visible ranges have been determined at 10°, 25°, and 40°C. for KNO_3, K_2CrO_4, diphenyl sulphone, diphenyl phosphate (I), 4:4′-diaminobenzophenone, and *m*-cresolsulphophthalein, in aq. soln. The max. absorbance of all cpd. (except I) increases with decreasing temp., and there is a slight shift of the absorbance curves. The absorbance–temp. relationship is not linear within the temp. range studied. The results show that temp. should be controlled within ± 2°C. if molar absorbance values are to be obtained within 0·5%. Temperature coefficients for an individual cpd. require extensive absorption measurements of that cpd. in known media, and they are valid for the specified wavelengths only under specified conditions. J.W.D.

Metallochromic Indicators of the Complexone Type
J. Körbl and R. Přibil
Chem. and Ind., 233–234 (23 Feb. 1957)

Twelve 3 : 3′ - *bis*NN - di(carboxymethyl)aminomethyl derivatives of acid–base indicators of the phthalein and sulphophthalein groups have been prepared and are listed. The cpd. were prepared by a procedure (patent applied for) involving the condensation of one mole of the dye with two moles of iminodiacetic acid and two moles of HCHO. Their properties are discussed. The utility of these cpd. as complexometric indicators or colorimetric reagents is limited to that range of pH which lies below their own acid–base last colour transition. For each indicator combination there is a certain min. pH value at which reaction will still occur, with a resultant change in colour. J.W.D.

Tests for Aluminium and Hydroxytriphenylmethane Dyes
F. Feigl and D. Goldstein
Anal. Chem., **29**, 456–458 (March 1957)

The production of a coloured chelate compound by reaction of aluminium ions with a hydroxytriphenylmethane dye in neutral or alkaline soln. may be used to show the presence of either. The test will detect 0·1 μg. aluminium in one drop when Chrome Fast Pure Blue B (C.I. Mordant Blue 1) is used as reagent, and 0·1–5 μg. of hydroxytriphenylmethane dye with aluminium ions as reagent. L.T.W.

Identification of Anthocyanidins, Leuco Anthocyanins, and 2:3-Dihydroflavonols in Plant Tissues
D. G. Roux
Nature, **179**, 305–306 (9 Feb. 1957)

C–H Stretching Bands of Methoxyl Groups
H. B. Henbest, G. D. Meakins, B. Nicholls, and A. A. Wayland
J.C.S., 1462–1464 (April 1957)

Methoxyl groups in org. compounds are found to be detectable by a characteristic band in the 2832–2815 $cm.^{-1}$ region of the infrared spectrum. H.H.H.

Detection of the Epoxide Group by Infrared Spectroscopy

H. B. Henbest, G. D. Meakins, B. Nicholls, and K. J. Taylor

J.C.S., 1459–1464 (April 1957)

Whereas previous work on detection of epoxide groups in org. mol. by infrared measurements has been inclusive in the regions 1300–650 cm.$^{-1}$, it is now found that for particularly alkylated ethylene oxides of moderate mol. wt., a characteristic C–H stretching band can be detected in the 3050–2990 cm.$^{-1}$ region. Correlations between band position and epoxide structure are discussed.

H.H.H.

Personal Experience with the Inter-Society Color Council Colour-aptitude Test

M. Hess

J. Oil & Col. Chem. Assocn., **40**, 136–142 (Feb. 1957)

The test is intended to assess the aptitude of personnel for colour-matching, and it gives no information regarding colour-blindness; it should be preceded by a test for colour-blindness by the Farnsworth or Ishihara charts. Four sets of 12 chips (blue, red, green, and yellow) are arranged in random order in rows on a grey background; the steps in each series are equal and are ca. 0·2 Munsell chroma. A matching set of 48 chips is presented to the candidate in a plastic dispenser in an order which, although randomly conceived, is always the same. The loose chips are assessed against the mounted ones in the order in which they are delivered, and their reference number entered on a score sheet against the estimated matching chip; the same number must not be entered in more than one position, but any one mounted chip may be marked as the nearest match for any number of loose ones. Only 40 chips score, the first 8 being regarded as affording acclimatisation. The score is based upon the closeness of each assessment, and totals are recorded for the chips of each of the four colours, and also for the whole operation; the time taken is also noted. Colour-matching ability appears to be unrelated to age, and does not seem to improve with experience. It is recommended that all personnel concerned with colour (including sales staff) should be tested, at intervals of not greater than a year. Colour-aptitude is important to the colour-matcher, but the knowledge of what to use to match or correct a colour, with as few components as possible, is equally important.

J.W.D.

Aspects of Colorimetry applied to the Colour Gamut of Pigments

E. Atherton and D. Tough

J. Oil & Col. Chem. Assocn., **40**, 115–128 (Feb. 1957)

In an attempt to relate directly the optical properties of pigment layers to the practical assessments of the colourist, the colour properties of a pigment are represented by a model reflectance curve having discrete regions in which scattering and absorption predominate by turns. The addition of a white to a coloured pigment is discussed in terms of such a model, and the expression is derived—

$$\left[\frac{1}{({}_{i}R_{\infty}-\rho)}-1\right] = K\left[\frac{1}{({}_{o}R_{\infty}-\rho)}-1\right]$$

where ${}_{i}R_{\infty}$ and ${}_{o}R_{\infty}$ are the reflectances inside and outside the band (with an idealised pigment having one region of scattering and one of absorption) respectively, ρ is the surface reflectance coefficient, and K is a constant defining the brightness of the pigment. The colour changes accompanying dilution with a white pigment may be calc. by attributing a series of values to ${}_{i}R_{\infty}$ and ${}_{o}R_{\infty}$ and converting the results to C.I.E. co-ordinates to find the loci within the colour solid. If these pigment loci are taken to represent a number of pigments, the problem is how to compare their colorimetric performance. A method is suggested and discussed at length, in which the ratio of the distances between the neutral axis and the point of max. purity on the pigment locus and the limit locus at the same hue and lightness is measured.

J.W.D.

Colorimetry in the Paint Industry

A. J. Seavell

J. Oil & Col. Chem. Assocn., **40**, 87–114 (Feb. 1957)

The C.I.E. system is described, the principle of the spectrophotometer is explained, and the embodiment of trichromatic colorimetry within the fabric of the C.I.E. System is discussed in detail; the mathematical expression of colour quality is developed. An investigation is described (19 chromaticity diagrams and reflectance curves are reproduced) which shows that paints do not retain their colour indefinitely, and the drift is likely to become significant after 12 months or less; brush-outs alter more rapidly through yellowing and, to varying degrees, dirtying off. Colour stability depends on both pigments and medium and the system must be considered as a whole. With a given medium, existing evidence is that the stability of a mixed pigment system cannot be computed, e.g. as a mean of the additive properties of the pigments present. Though there is no substitute for a trained human eye in colour matching, instrumental records such as those described are the only reliable method of maintaining constant colour standards over long periods of time.

J.W.D.

Hiding Power from only Photometric Measurements

P. B. Mitton

Off. Dig. Fed. Paint Varn. Prod. Cl., **29**, 188–201 (Feb. 1957)

It is shown from a review of a number of Kubelka–Munk equations that if S, the scattering coefficient, is known from independent measurements, then the hiding power of a paint in sq.ft./gal. (U.S.A.) may be calc. from photometric measurements. An independent measurement of S may be obtained from the equation—

$$\frac{C_1K_1+C_2K_2+\ldots+C_nK_n}{C_1S_1+C_2S_2+\ldots+C_nS_n} = \frac{(1-R_{\infty})^2}{2R_{\infty}} = \frac{K}{S}$$

where R_{∞} is the reflectivity (easily calc. from photometric measurements), C is the concn., K is the absorption coefficient, and S is the scattering coefficient. Three modifications are proposed by which K is either fixed or calc., thus allowing S to be obtained: (i) K can be fixed by adding a known amount of a colorant to a white paint; (ii) K may, for the unknown paint, be closely approximated by mixing with this paint a standard paint of known K and S values and solving two simultaneous equations; and (iii) S may be closely approximated by reducing the PVC (pigment vol. conc.) of the unknown paint with additional vehicle of a known K value, and solving two simultaneous equations. Experimental verification of each of these methods is cited. Possible future procedures based on this approach are indicated.

J.W.D.

Simple Method for Computing the Increase in Hiding Power of a White Paint for a Decrease in Reflectance Level

P. B. Mitton

Off. Dig. Fed. Paint Varn. Prod. Cl., **29**, 251–255 (March 1957)

Three known methods for determining reflectivity are briefly reviewed. The sq.ft./gal. (U.S.A.) increase in hiding power for a given decrease in reflectivity is found either (i) by the use of graphs (which are shown) of hiding power *versus* both wide and narrow ranges of reflectivity; there are curves for each of a number of values of S (the Kubelka–Munk scattering coefficient), or (ii) by calculation. The hiding power is multiplied by the ratio between two values of a factor ("Factor A") corresponding to the required reflectivity divided by the initial value. Factor A varies with the reflectivity, and a series of values are tabulated; intermediate values may be obtained by linear interpolation. Both versions of the method are limited to non-chromatic paints, but it can yield useful information for chromatic paints which do not differ much in hue. The amount of toning agent added must not appreciably alter the scattering coefficient of the system.

J.W.D.

Assessment of Light Fastness

J. G. Gillan

J. Oil & Col. Chem. Assocn., **40**, 129–135 (Feb. 1957)

Two projects instituted by the Light-fastness Committee of the above Association are reported; the second had not been completed at the time of writing. In the first, 19 paint panels which had been exposed as a set, alongside the blue wool standards (*B.S.* 1006), were given independent fastness assessments by a number of separate observers. The panels were exposed so as to produce three areas having progressively longer periods of exposure, and ratings were required for each of these. The assessments showed a considerable spread, especially in those cases in

which the colour darkened rather than faded; repeated assessments after further instruction regarding the interpretation of such cases (and not so far complete) reduced the spread but did not eliminate it. The results are tabulated and discussed; they are not altogether satisfactory. In the second project, groups of members were formed, and each was provided with a set of three paint panels and standards, together with instructions regarding their exposure; this introduced the step of exposure prior to assessment. The results are tabulated and discussed; again, they are not wholly satisfactory. It is considered that the spread of results is due to the inexperience of the observers rather than to defects in the system of *B.S.* 1006, and that it should be possible to apply the blue-scale procedure to paint systems satisfactorily. J.W.D.

Microscopic Studies on Woven Goods
N. Bigler

SVF-Fachorgan, **12**, 224–238 (April 1957)

Techniques for studying the surfaces and cross-sections are described, and a number of photomicrographs are included as examples. S.R.C.

Phase-contrast Microscopy
H. Reumuth

SVF-Fachorgan, **12**, 2–19 (Jan. 1957)

A detailed description of the principles and apparatus used in phase-contrast microscopy and the application of this technique to textile technology, e.g. in the detection of differences in fibre structure due to physical and chemical treatments, the examination of solutions of auxiliary products and chemicals used in the treatment of textiles, and the examination of emulsions. B.K.

Determination of the Hydroxyl Values of Organic Substances extracted from Textile Materials
A. G. Hamlin

J. Textile Inst., **48**, T 81–T 85 (March 1957)

A micromethod for the estimation of the hydroxyl values (number of mg. of KOH equivalent to the acetic acid combining with 1 g. of the substance on acetylation) of substances removed from textile materials by solvent extraction. The method is thus a means of identifying oils, fats, and waxes which have been extracted from the textile material, since their hydroxyl values are characteristic. The solvent is evaporated from the extract which is acetylated with acetic anhydride in pyridine. Titration with NaOH is used to estimate the acetic anhydride consumed in the reaction. Full experimental details are given, including a method of removing fatty acids and coloured substances (which interfere with the estimation) from the acetylated extract by means of molten paraffin wax. Some typical results are given, showing an accuracy of about 5%. P.T.S.

Wear Tests with the Accelerotor
A. R. Macormac and F. M. Richardson

Amer. Dyestuff Rep., **46**, 149–151 (25 Feb. 1957)

The Accelerotor is an abrasion-testing machine which gives results for the resistance of fabrics to wear which are comparable, with the actual wearing qualities of the fabrics in use. The chief cause of wear is fibre breakdown. A method of estimating the degree of mechanical degradation is given. The number of fibres in a cross-section of yarn is measured, and then the number of fibre ends per inch of yarn, divided by the number of fibres in the cross-section, is a measure of the fibre breakdown. This is related to the duration of the Accelerotor test. Three whipcord worsted fabrics were used in the experiments—(i) 100% 64*s* wool, (ii) 75% 56–8*s* wool + 25% 3-denier staple rayon, (iii) 75% 56–8*s* wool + 25% 3-denier nylon. The Accelerotor put their wearing qualities in the order: (iii) > (i) > (ii). The same order was found in use. The paper gives a staining technique to distinguish between wool and nylon (even when they are dyed navy blue). In the wool–nylon mixture the fibres appear to be equally attacked in the abrasion test; they tend to break at approximately the same rate. P.T.S.

New Cotton Lustermeter for Yarns and Fibres
D. Nickerson

Text. Research J., **27**, 111–123 (Feb. 1957)

For an earlier reference to this instrument cf. J.S.D.C., **72**, 510 (1956). The present paper discusses the concept of lustre and gives an amplified description of the instrument and its use. Lustre results for the U.S.D.A. Standardised Variety Series of cottons are reported. J.C.F.

Amide Nitrogen in Proteins
S. J. Leach and E. M. J. Parkhill

Proc. International Wool Textile Research Conf. Australia, **C**, C 92–C 101, C 466–C 467 (1955)

Conventional analytical procedures for the determination of amide nitrogen content in proteins have been critically examined. The conditions of hydrolysis used for amino acids analysis (6N-HCl at 100°C.) lead to high results even after correcting for ammonia produced by serine and threonine breakdown. Time studies show that 12N-HCl at 37°C. produces no secondary breakdown. However, a linear extrapolation procedure using 2N-HCl at ca. 100°C. is suggested as a more rapid and convenient method and produces closely similar results. Analytical results are reported for both methods, on 7 proteins and using 12N-HCl at 37°C. for different samples of wool. P.G.M.

Dinitrophenylation of Wool
E. R. Fritze and H. Zahn

Proc. International Wool Textile Research Conf. Australia, **C**, C 119–C 126, C 471–C 472 (1955)

A method for the exhaustive dinitrophenylation of wool is given. The wool is treated at 60°C. with half its weight of fluoro-2:4-dinitrobenzene in alkaline bicarbonate solution, and 0·1N-HCl is used to remove adsorbed 2:4-dinitrophenol. P.G.M.

Partition Chromatography of Proteins
A. J. P. Martin and R. R. Porter

Proc. International Wool Textile Research Conf. Australia, **B**, B 14–B 21, B 269 (1955)

Available techniques for the separation of proteins by chromatographic methods are reviewed and factors limiting the application of the method are discussed. P.G.M.

Solubility of Wool in Urea–Bisulphite Solutions and its use as a Measure of Fibre Modification
K. Lees and F. F. Elsworth

Proc. International Wool Textile Research Conf. Australia, **C**, C 363–C 373, C 501–C 503 (1955)

The solubility of untreated wool in solutions containing urea and sodium metabisulphite is critically dependent on the pH value of the solution and on the metabisulphite concentration. Maximum solubility occurs when the bisulphite concentration is 3 g./100 ml. and the pH value 7·0 ± 0·1. The solubility of wool in urea–bisulphite solutions decreases when it is treated under alkaline conditions to an extent which depends on the conditions of treatment. The decrease in solubility is due to the formation of new stable cross-linkages during the alkaline treatment; treatment causing peptide hydrolysis results in an increase in solubility. Determination of the solubility of wool in urea–bisulphite solution is a useful means of assessing changes in the chemical properties of wool brought about in wet processing. P.G.M.

Detection and Determination of Cysteine in Wool with Fluoro-2:4-dinitrobenzene
H. Zuber, K. Traumann, and H. Zahn

Proc. International Wool Textile Research Conf. Australia, **C**, C 127–C 136, C 471–C 472 (1955)

Untreated wool and wool treated with KCN, NaOH, epichlorohydrin, $NaHSO_3$, $NaHCO_3$, and acetone, phenol, or acetate buffer, as well as heated wool and weathered wool, have been treated with F.D.N.B. at pH 5 and 60°C. *S*-Dinitrophenylcysteine has been separated from the hydrolysate by paper electrophoresis. The isolated compound is determined spectrophotometrically at a wavelength of 330 mμ. By use of this method minute amounts of cysteine have been determined in the wool preparations treated as previously described. P.G.M.

Estimation of Cystine and Lanthionine
E. O. P. Thompson

Proc. International Wool Textile Research Conf. Australia, **C**, C 102–C 118, C 467–C 471 (1955)

A method has been developed for the determination of the cystine plus cysteine of protein hydrolysates based upon the oxidation of these residues by bromine followed by estimation of the resulting cysteic acid isolated on columns of ion-exchange resins. Under certain conditions cystine and cysteine give quantitative recoveries but attempts to apply the method to unhydrolysed proteins have so far given incomplete recoveries. Preliminary partial hydrolysis of proteins with mixtures of formic with

either hydrochloric or hydrobromic acids followed by bromine oxidation and further hydrolysis, has given values lower than those obtained colorimetrically, but higher than those obtained polarographically on the same hydrolysate. The destruction of cystine and cysteine during preliminary hydrolysis is minimised by oxidising partial hydrolysates, followed by further hydrolysis to liberate the cysteic acid which is stable.

The oxidation of lanthionine by bromine, performic acid, and hydrogen peroxide solutions has been studied and a method for the rapid separation of lanthionine, cystine, and their oxidation products from other amino acids by one-dimensional paper chromatography in mesityl oxide–formic acid–water systems has been developed. This method of detecting lanthionine has been used to demonstrate its formation during alkaline treatment of the cystine peptides in partial hydrolysates of wool and in wool treated under a variety of conditions. P.G.M.

Analytical Reviews

Anal. Chem., **29**, 589–734 (April 1957)

The review is the combined work of 21 authors and covers 15 fields in which analysis is very important. L.T.W.

Quantitative Determination of Organic Nitrogen in Water, Sewage, and Industrial Wastes

G. B. Morgan, J. B. Lackey, and F. W. Gilcreas

Anal. Chem., **29**, 833–835 (May 1957)

A modified Kjeldahl method for routine determination of org. nitrogen in sewage and industrial wastes uses a mercuric sulphate–potassium sulphate catalyst. Comparison is made with other Kjeldahl procedures. L.T.W.

Polyanion-stabilised Diazonium Cations and Diazonium Spot Test Papers as Analytical Reagents

J. L. Lambert and V. E. Cates

Anal. Chem., **29**, 508–512 (April 1957)

Diazonium cations can be stored for long periods in absence of light on a dry sulphonic-acid exchange resin. They can be removed as required by ion-exchange for use as a qual. and quant. analytical reagent for determination of certain aromatic compounds. Of a large number tested, 2:5-dichloro-, 4-nitro-, and 2-carboxy-4-nitro-benzenediazoniums were most satisfactory. The diazonium ion of *p*-arsanilic acid, bound to filter paper as the zirconium salt, is described as a spot-test reagent for phenols and amines. L.T.W.

Spectrophotometric Determination of Beryllium with Eriochrome Cyanine R

S. Umemoto

Bull. Chem. Soc. Japan, **29**, 845–852 (Nov. 1956)

Photometric Method for Determining Thallium with Rhodamine B

H. Onishi

Bull. Chem. Soc. Japan, **29**, 945 (Nov. 1956)

Paper Chromatography of Dyes permitted by Food Regulations. I—Coal-tar Dyes. (*c*) Rose Bengal–Erythrosine Mixture

O. A. Valenciano and A. Ibarra

Rev. Asoc. bioquim. arg., **21**, 141–147 (1956): *Chem. Abs.*, **51**, 7221 (25 May 1957)

CH_3OH, C_2H_5OH, C_3H_7OH, *iso*-C_3H_7OH, butanol, *iso*butanol, and amyl alcohol were tested as elements for separating Rose Bengal–Erythrosin mixtures on Schleicher & Schüll paper 595 and Whatman paper No. 1. Only 60–65% CH_3OH or 30–40% C_3H_7OH on Whatman paper gave satisfactory separation; the R_f for Rose Bengal was 0·81–0·84 and 0·90–0·92 and for Erythrosin 0·73–0·77 and 0·83–0·85 respectively. C.O.C.

Extraction and Chromatography upon Alumina of Various Dyes

M. Mottier

Mitt. Gebiete Lebensm. u. Hyg., **47**, 372–386 (1956): *Chem. Abs.*, **51**, 7723 (25 May 1957)

Fifty water-soluble dyes, extracted with quinoline in presence of an acetic acid–sodium acetate buffer, and 10 liposoluble dyes, extracted on Al_2O_3, were subjected to chromatography. With the water-soluble dyes, the final extract or the starting spot on the Al_2O_3 plate had to be made alkaline with NaOH, because the acetic acid of the buffer transformed the dyes into free acids which were less soluble and more easily adsorbed. The dyes moved best as salts on Al_2O_3. A modification of Matthins and Swerdtfeger's method of preparing Al_2O_3 plates is described. C.O.C.

Analysis of Sound produced by Fabrics in Friction

W. J. Thorsen and H. P. Lundgren

Proc. International Wool Textile Research Conf. Australia, **E**, E 294–E 314, E 585–E 586 (1955)

An acoustic device has been developed to measure the spectral distribution of sound produced by fabrics in friction. Measurements in the 300–2,000 cycles/sec. region show that the distribution and intensity of the sound vary with fabric construction and individual fibre properties. These variations correlate well with fabric handle as determined tactually by a panel. P.G.M.

Determination of Residual Mineral Acids in Wool

M. Oku and I. Shimizu

Proc. International Wool Textile Research Conf. Australia, **E**, E 421–E 424, E 600 (1955)

A new, accurate and convenient method for the determination of residual H_2SO_4 or HCl is given. It consists in the replacement of the residual H_2SO_4 in wool by warming with 0·13–0·25 N-HCl at 75°C. for 20 min., followed by the determination of the total acids by stepwise titration with 0·1 N-NaOH, titration of chloride with 0·1 N-$AgNO_3$, and calculation of the amount of H_2SO_4 by subtracting the amount of HCl from the total acids (HCl + H_2SO_4). In the case of HCl determinations, residual HCl, replaced by H_2SO_4, is titrated with 0·1 N-$AgNO_3$. P.G.M.

Determination of Monomeric 6-Hexanolactam and of Moisture in 6-Nylon

H. H. Schenker, C. C. Casto, and P. W. Mullen

Anal. Chem., **29**, 825–829 (May 1957)

A vacuum-extraction technique which is rapid, accurate, and specific for 6-hexanolactam monomer in 6-nylon is carried out at 200°C. The monomer is collected in a cold trap, dissolved in water, and determined by refractive index measurement. Moisture can be determined simultaneously from the weight loss of the sample. L.T.W.

Rapid Methods of Control in Wool Washing

D. P. Veldsman and R. C. Palmer

Proc. International Wool Textile Research Conf. Australia, **E**, E 331–E 341 (1955)

Rapid methods suitable for industrial control of wool washing are described for—(*a*) the residual grease in washed wool, (*b*) the residual alkali in washed wool, (*c*) the residual soap in washed wool, (*d*) the grease content of effluent, and (*e*) the water content of centrifuged wool grease. The rapidity of methods (*a*), (*b*), and (*c*) depends on getting an adequate flow of liquid past the surface of the fibres. The pH of the water extract is shown to bear little relation to the total alkali content of the wool. It is shown that only about half the alcohol extract (following ether) of wool consists of soap. P.G.M.

Polarographic Reduction of Chlorites and Bromates in Anhydrous Ammonia

R. Curti and S. Locchi

Anal. Chem., **29**, 534–537 (April 1957)

Chlorite can be determined polarographically in liquid ammonia because the chlorite discharge overvoltage on mercury is much less in ammonia than in water. The supporting electrolyte is a soln. of ammonium thiocyanate in anhydrous ammonia. Bromate can be determined similarly. L.T.W.

Estimation of Melamine in Presence of Guanidine

R. M. Engelbrecht, H. E. Moody, W. P. Donahoo, and W. R. Rolingson

Anal. Chem., **29**, 579–580 (April 1957)

Three methods for the separation of melamine and guanidine are described—(1) pptn. of melamine picrate in acetic acid soln., (2) pptn. of guanidine picrate in alkaline soln., and (3) extraction of melamine with boiling 10% NaOH. L.T.W.

Propagation of Flame over Textiles

D. I. Lawson

Brit. J. Plastic Surg., **9**, 186–194 (1956)

The vertical flame speed (in sec.) of various fabrics can be measured by weighing the fabric continuously on a torsion balance while it is burning. All cellulosic materials

propagate flame at a rate inversely proportional to their wt. per unit area, e.g. $WV = 9{\cdot}3$ (W = oz. per sq.yd.; V = vertical flame speed). Apparatus simpler than the torsion balance consists of a semicircular arched track over which the fabric is stretched. The samples lit at one end and the final distance of burning, D, and the time, T, are measured. From D and T, V can be measured by torsion balances; $V = 0{\cdot}31\ D^{3\cdot5}/T$. The "figure of merit", M, = time taken for the flame to move 100 in. vertically and is obtained from $M = 320\ T/D^{3\cdot5}$. Typical values are cotton net 8, cotton 24, rayon 33, acetate 37, 40 : 60 wool-cotton 42, 60 : 40 wool-cotton 45, wincyette 45, wool (5·6 oz./sq.yd.) 45, cotton 71, Terylene 90, rayon 90, wool (7·5 oz./sq.yd.) 143, 50 : 50 wool–nylon 200, wool serge, nylon and Terylene > 1000. Hospital statistics show that most burning casualties are linked with fabrics of M 25–65.

C.O.C.

Application of the Anthrone Test to Determination of Cellulose Derivatives in Non-aqueous Media

E. P. Samsel and J. C. Aldrich

Anal. Chem., **29**, 574–576 (April 1957)

Small amounts of cellulose derivatives in oils, fats, and glycols can be estimated by the anthrone test after an extraction process. Ethylcellulose is extracted with a mixed methanol–water solvent and cellulose acetate–butyrate with methanol–acetone mixture.

L.T.W.

Determination of the Degree of Polymerisation of Cellulose Nitrates by Viscometric Measurements. II— Evaluation of the Experimental Results

W. Lang

Svensk Papperstidning, **60**, 233–242 (15 April 1957)

The Schulz–Blaschke formula has been applied to the determination of the limiting viscosity. In order to correct errors in the results of the experimental measurements, the limiting viscosity is determined at different concentrations and extrapolated to zero viscosity. This procedure can be facilitated by the use of a template designed according to the Schulz–Blaschke formula; subjective errors are thereby also minimised. The constant $K_\eta = 0{\cdot}315$ was found to be valid for cellulose nitrate dissolved in butyl acetate within the range investigated. By neglecting the Hagenbach correction, reproducible values of the limiting viscosity are obtained that are, however, 5–15% too low. If the influence of the velocity gradient D and the shearing stress τ is neglected, the values for high-polymer cellulose (cotton) will be 20% too low and for cellulose of average D.P. 10% too low. No error could be detected in the case of viscose rayon (D.P. $\simeq$ 300). For the elimination of the errors, it is suggested that measurements are taken at different shearing stresses, and the reduced viscosity (η_{sp}/c) is extrapolated to zero shearing stress. K.W.

Determination of Acetyl Content of Cellulose Acetate by Near-infrared Spectroscopy

J. A. Mitchell, C. D. Bockman, and A. V. Lee

Anal. Chem., **29**, 499–502 (April 1957)

Acetyl content of cellulose acetate can be determined rapidly by measuring the infrared absorbance due to residual hydroxyls. Samples are dissolved in pyrrole and measurements made at 1445 mμ. The method can be accurately calibrated and its precision is of the same order as that of the Eberstadt method. L.T.W.

Determination of Acetyl in Pectin and in Acetylated Carbohydrate Polymers

E. A. McComb and R. M. McReady

Anal. Chem., **29**, 819–821 (May 1957)

Reaction of ester groups in pectin with hydroxylamine yields hydroxamic acids; with ferric ions pectinhydroxamic acid forms an insol. complex, while acetohydroxamic acid, produced from secondary acetyl groups in pectin, forms a sol. red complex. These reactions serve as a basis for a specific and rapid colorimetric method for the determination of up to 450 μg. of acetyl per sample of pectin with an accuracy of ± 2%. The method can also be applied to the quant. determination of acetyl in acetylated carbohydrate polymers. L.T.W.

Determination of Traces of *iso*Cyanate in Urethan-based Polymers

K. A. Kubitz

Anal. Chem., **29**, 814–816 (May 1957)

New, extremely sensitive tests are described for traces (< 0·5%) of unreacted *iso*cyanate groups in urethan-based polymers. In the quant. determination, *n*-butylamine is added and the excess determined colorimetrically with Malachite Green (C.I. Basic Green 4). In a rapid qual. test, a colourless secondary amine derived from Malachite Green reacts with *iso*cyanate to form a coloured product. L.T.W.

PATENTS

Testing the Physical Properties of Sizing Liquids

Gebrüder Sucker *BP* 768,427

Modification of *BP* 740,922 (J.S.D.C., **72**, 135 (1956)), enabling the viscosity of liquid to be determined either simultaneously or alternately with determination of its adhesive properties. C.O.C.

Continuous Thickness Measurement of Paper, etc.

Brittains *BP* 772,739

The apparatus comprises two electrodes in the form of conductive or semi-conductive rollers, one of which has a fixed axis and is earthed, the other being adjustable and connected to a negative voltage supply. The paper passes between the rollers and is in contact with them. A controlled electrical discharge is caused to pass through the air spaces in the paper, and the voltage required for discharge is measured, the magnitude of the voltage being directly proportional to the thickness of the web. This method is claimed to overcome the disadvantages inherent in dielectric capacity and β-ray gauge measurements. K.W.

Apparatus for Measuring the Hardness of Water

Ionics *USP* 2,736,637

Pretreatments which affect the Susceptibility of Wool to Proteolysis. I— Effects of pH, Wetting Agents, and Solvent Extraction (VI p. 344)

Ion Exchange on Dicarboxycellulose (XI p. 353)

XV—MISCELLANEOUS

Rôle of Colour in Cosmetics

D. H. Powers

J. Soc. Cosmetic Chemists, **7**, 541–552 (1956); *Chem. Abs.*, **51**, 3935 (10 March 1957)

Review, 30 references. C.O.C.

Dispersion of Pigments in Lipstick

M. Jakovics

Proc. Sci. Sectn. Toilet Goods Assocn., **26**, 9–11 (1956); *Chem. Abs.*, **51**, 3934 (10 March 1957)

Adsorption of gas on pigment particles has an important effect on the ease of dispersion of the pigment and the consistency of the finished lipstick. C.O.C.

Reversibility of Fluorescence on Annealing

K. Przibram

Nature, **179**, 319–320 (9 Feb. 1957)

The bluish-greenish fluorescence shown by many minerals (including felspars, Monte Baldo wollastonite, Bleiberg anhydrite, certain zeolites, and some chemicals in varying degree of purity, e.g. sulphates and carbonates of the alkali and alkaline-earth metals) when excited by ultraviolet radiation of wavelength 365 mμ. is due to adsorbed water. The fluorescence is quenched by strong heating and reappears in presence of moisture, or when strongly heated samples are heated again to a less degree (fluorescence, reversible by annealing). During strong heating all water is driven off and fluorescence ceases; during cooling in open air, water vapour condenses on the surface without giving rise to fluorescence, but renewed heating supplies the energy of activation required to bind the water molecules more firmly than by mere surface adsorption. In this state, intermediate between surface adsorption and water of crystallisation, fluorescence occurs.

J.W.D.

APPOINTMENTS

Advertisements relating to APPOINTMENTS VACANT, APPOINTMENTS WANTED, and MISCELLANEOUS ITEMS are invited for insertion on this page. Advertisements of Appointments Wanted are gratis to members, but must not exceed twenty-four words.

All inquiries relating to Advertisements should be addressed to THE GENERAL SECRETARY, THE SOCIETY OF DYERS AND COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE.

Replies may be addressed Box —, THE SOCIETY OF DYERS AND COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE, where all communications relating to these Advertisements are treated in strict confidence.

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CHIEF DYER required to take charge of a dyehouse in Dundee. Applicants should be in the 35–45 age group and have extensive practical experience of all dyehouse work. The successful applicant requires to supervise the dyeing of jute and other types of yarn, also cloth dyeing, proofing and finishing. This post is salaried, superannuated, and, if necessary, a house will be provided. Applications, giving full particulars of experience, to the Staff Manager, Jute Industries Limited, Meadow Place Buildings, Dundee. Closing date 31st July 1957.

FOREIGN Dyestuffs Manufacturer wants DYESTUFF CHEMIST or experienced Technician or Foreman in starting and supervising the manufacture of

RHODAMINE AURAMINE VICTORIA BLUE

and also Chemist or Technician for

SULPHUR DYES SODIUM SULPHIDE

Detailed confidential applications to Box V128.

TECHNOLOGIST required by large concern engaged in specialised branch of woollen industry. Advertisers are extensive processors of synthetic fibres and contemplate extension into production of bonded fibre fabrics. Applicants should have some practical experience of production problems in the synthetic fibre field in addition to academic qualifications. Age not below 25. Give fullest details of past experience and chemical knowledge. Pension Fund in operation. Box V127

REQUIRED— Assistant Dyer for cotton piece goods, Manchester district. Reply stating previous experience and salary required to Box V129.

BRITISH RAYON RESEARCH ASSOCIATION

THE Association has a vacancy for a chemist, preferably of B.Sc. or A.R.I.C. standard, to work in the chemical laboratory of the Testing and Member Service Department. The successful candidate will receive a thorough training in the practical application of textile chemistry. Salary will depend upon age and experience. The F.S.S.U. scheme is in operation. Apply to the Appointments Officer, British Rayon Research Association, Heald Green Laboratories, Wythenshawe, Manchester 22, quoting reference M6.

APPOINTMENTS WANTED

TEXTILE CHEMIST AND TECHNOLOGIST, F.T.I., 45, seeks position of responsibility. Wide experience of technical administration, technical service and product development and practical textile dyeing and wet processing. Specialist in the formulation, development, technical servicing and practical application of textile auxiliaries and particularly where emulsion technology is involved. Responsible for the formulation and development of moth-proofing emulsions and showerproofing and retexturing compounds of leading dyestuff manufacturer. Position is sought with users or makers of Textile Auxiliaries and Dyestuffs where technical ability can be given full scope. Free to assume duties in very near future. Box W586

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The Society is urgently wanting Journals for all months of 1955 except July and December. The months of January, February, March, August and September 1955 are particularly required. Copies of January, February, March, April, July, September and December 1956 issues are also in demand. Please address communications to the General Secretary.

INDEX TO ADVERTISERS

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